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Gender relations as a basis for varietal selection in production spaces in Yucatán, México

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Gender relations as a basis for varietal selection in production spaces in Yucatán, México

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Developed within the research core group:
Gender Studies in Agriculture &
Bio-Culture Diversity Studies

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LIST OF ACRONYMS

CINVESTAV IPN	Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional
CIMMYT	Centro International de Mejoramiento de Maíz y Trigo
ICBN	International Code of Botanical Nomenclature
ICNCP	International Code of Nomenclature for Cultivated Plants
IPGRI	International Plant Genetic Resources Institute
OPV	Open pollinated varieties
QPM	High protein/amino acid improved populations

1 INTRODUCTION

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Chapter 1: Introduction

1.0 Introduction

Around the 1980's, attention started to be paid to the conservation of plant genetic resources in the places where they have originated and/or evolved. Within this approach, known as *in situ* conservation, traditional farming communities have been recognized as the main guardians of crop intra-specific variability and its conservation through continuous use and management. Mexico, as part of Mesoamerica, is considered as one of the centres of diversity and origin of plants cultivated within the traditional agricultural system known as (Aztec) '*milpa'*, meaning maize field. The *milpa* system consists of the associated planting of maize (Zea mays), beans (Phaseolus vulgaris), lima beans (Phaseolus lunatus), cowpea (Vigna unguiculata) and squash (Cucurbita spp.). The most extensive research in the world on maize agrobiodiversity has been done in Mexico, on temperate upland (i.e. Smale personal communication 2004 citing Bellón and Brush 1994; Ibid citing Perales *et al.* 1998; Aguirre *et al.* 2000), but as yet with little focus on the subtropics of Yucatan (i.e. Chavez-Servia *et al.* 2000).

Since 1995, efforts have been made to understand how, why and under what circumstances, rural Mayas in the maize belt region of the State of Yucatan conserve genetic variability in maize, bean, squash and chile (Jarvis *et al.* 2000b). As of 2002, exploratory research in the area (Lope *et al.* 2001; Lope 2002) identified that the active role of women in the production system seems to be expressed through: 1) the performance of activities and decision-making regarding production in homegardens [(Sp.) *solares*]; 2) to some extent, in seed exchange activities; 3) in specific activities in *milpas* (in this document referred to as 'agricultural fields'; 4) and by influencing or participating directly in selecting which maize, squash and bean cultivars will be sown in the next agricultural cycle in agricultural fields. However, this did not yield sufficient data on the influence that women have on overall varietal selection in relation to their responsibilities, knowledge and needs within the production-consumption chain.

In order to understand how, why and under what circumstances crop diversity is maintained in the maize belt region of the State of Yucatan, the roles and responsibilities of rural Mayan women need to be recognized by research and development communities as a crucial to the promotion of agrobiodiversity conservation, and therefore women need to be supported as such. As a means to contribute to such an assessment and understanding, the research here presented aims to explore gender relations in varietal selection for maize and squash crops. This has been done through exploratory qualitative research where it was posited that (see Figure 1.1):

1) Varietal selection is influenced by agroecological and environmental factors, access to inputs (i.e. seed, labour force availability), and social, economic and cultural factors that are gendered (Jarvis *et al.* 2000b[1]; Howard 2003);

2) Access to inputs and agroecological and environmental factors influence post harvest management (storage, processing and food preparation);

3) Women have an influence on varietal selection decision-making in agricultural fields as men's spaces, and in homegardens as their own spaces, and *vice versa*, men have an

[1]Research done from 1998-2003 by the collaborative team of the multidisciplinary project 'Strengthening the scientific basis of *in situ* conservation of agrobiodiversity on farm: Mexico country component' by the International Plant Genetic Resources Institute (IPGRI) in collaboration with seven national institutions (CINVESTAV-IPN, Universidad Autónoma Chapingo, Colegio de Posgraduados, Instituto Nacional de Antropología e Historia, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, Instituto Tecnológico Agropecuario No. 2, Instituto Tecnologico de Mérida).

influence in homegardens as women's spaces and in agricultural fields as their own spaces. Moreover, women and men are not separate entities in the decision-making processes about what cultivars to grow and the production-consumption chain, however, they have different preferences and interests regarding which varieties to select and grow;

4) Final forms of use, in the domestic sphere and in markets, influence decision-making and preferences in the production-consumption chain for varietal selection by both men and women. However, since most of the product in the community under study is for own consumption, many of the criteria for varietal selection are established within the domestic sphere[2];

5) There is a relationship between men's and women's production spaces with respect to the production of the varieties under study.

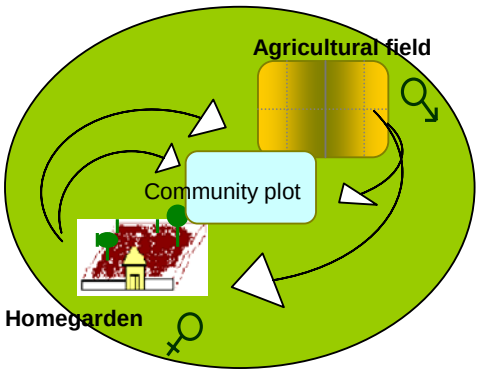

Figure 1.1 Gender interactions in production spaces. Men's and women's decisions about varietal selection, and the production system in general, are not independent of each other, although preferences and interests may differ. Agricultural fields, traditionally seen as men's production spaces, provide relatively large amounts of staple crops, consumed in several forms during the year. At the same time, homegardens, considered as the women's production space, besides providing products all year round for own consumption, exchange, and marketing, may serve as sites for conservation and as experimental fields for testing varieties before sowing them in the fields. The interaction between the two spaces further depends on demands within the domestic sphere, and, to a lesser extent, to markets; on labor availability and labor demands; and on men's and women's needs, interests and preferences. The interaction between the two spaces further depends on demands within the domestic sphere, and, to a lesser extent, to markets; on labor availability and labor demands; and on men's and women's needs, interests and preferences. In addition to the homegarden, a 'modern' production space may serve for the same interaction purposes, where men-women relations seem to be more egalitarian.

Aside from its practical value, the research is intended to contribute to the formation of a conceptual framework for understanding of gender relations in crop genetic diversity management and conservation for purposes of further research. This chapter provides an introduction and background for the research topic and describes it in detail; defines the research objectives and propositions and the conceptual bases for this work. Chapter 2 describes in detail the research strategy; explains the nomenclature used to present the cultivars under study which is based on the International Code of Nomenclature for Cultivated Plants (Trehane *et al.* 1995) as well as vernacular names; briefly describes the agroecological, economic, social, and historical context of the study site as well as the main production spaces that conform the traditional agricultural system [(Aztec-Mayan) *milpa ko'ol*]. Chapter 3 presents the interactions among production spaces as gendered domains for crop diversity conservation, beginning with a discussion about the different types of cultivars found in the households. It then presents the diversity encountered in the research sample, reasons to maintain such diversity and to produce a given cultivar in a given space, and it continues with a discussion about the relation between gender and specific cultivars. Chapter 4 focuses on the production-consumption chain and makes a comparison between

[2]It is already known that both agroecological context and market orientation influence selection criteria. However, the remaining the criteria, determined within the domestic sphere, have barely been explored in the Mexican context. The research here presented therefore emphasizes this sphere.

men's and women's cultivar preferences and their respective roles within the production-consumption chain. It then discusses the relationship between agroecological selection criteria and post-harvest selection criteria and the implications for crop diversity conservation. Chapter 5 focuses on gender relations and norms and how these influence decision-making and decision-making power in varietal selection particularly by examining the 'negotiations' between men and women regarding varietal selection. Chapter 6 presents conclusions and recommendations for further research.

1.1 Research Topic

The research presented here focuses on the influence of women and gender relations in the selection of maize (Zea mays) and squash (Cucurbita spp.) cultivars in 'traditional' production spaces (men's agricultural fields and women's homegardens), and also in a 'new' production space (community plot) that was discovered during this research in a relatively commoditized village in the maize belt region of Yucatán State, México. The main variables under study are pre- and post-harvest management (storage, processing and food preparation), final forms of use, the domestic sphere, the market sphere, and gender relations and gendered norms[3] (see Figure 1.2).

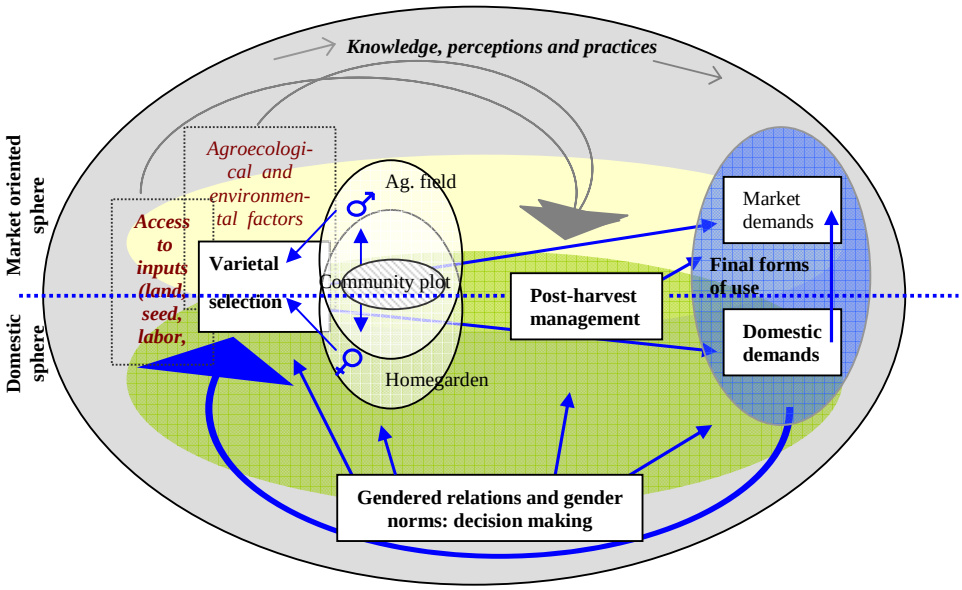

Figure 1.2 Research topic. *Varietal selection (VS)* occurs within a dynamic sphere of *knowledge, perception and practices,* determined in part by *gendered norms. VS* is also influenced by *agroecological and environmental factors* and *access to inputs*. The 'traditional' production spaces - *agricultural fields* (men's space) and *homegardens* (women's space) - are interdependent, as men and women influence each other and influence *VS*. Both are able to exercise their prerogatives most fully in the context of 'new' production spaces, the *community plots*. *VS* in the three spaces is the first step in the production-consumption chain where *storage* and *processing* (*post-harvest management*) are intermediate steps and *final forms of use* is the last step. *Storage* and *processing* are also influenced by *agroecological and environmental factors* and *access to inputs*. At the same time, *final forms of use* have a direct influence on *VS*. For the *market sphere*, although not fully assessed in this study, it may be the case that the intermediate steps take place off-farm and are determined by actors not involved in the household. *VS* and the whole production-consumption chain in local markets and household units are influenced by *gendered relations and gender norms* that are imbedded and manifest in the division of labour, in social, cultural and material relations and resource access, and are one basis for decision-making and decision-making power in negotiations between men and women. The research here presented concentrates on the topics and relations in bold font and bold arrows.

[3]In spite of the fact that the agricultural system in the area has been continuously studied since the 1980's, these variables that have not been approached from a social science perspective.

Spatial and temporal delimitation of the research

The research was done in the village of Yaxcabá, Yucatán, México, where genetic variability has been relatively recently assessed and characterized for the target species (Camacho 2002; Burgos *et al.* 2002, Canul *et al.* 2002). The research examined the 2002-2003 agricultural cycle corresponding to the period of fieldwork, although at times it refers to historical recall regarding specific cultivars.

1.2 Research problem and literature review

Mexico, as part of Mesoamerica, is considered as one of the centres of diversity and origin of maize (Zea mays), beans (Phaseolus spp.), and squash (Curcubita spp.) (Jarvis *et al.* 2000b). The traditional system, known as the '*milpa'* (Aztec - maize field) consists of policropping of these three crops, has persisted since Pre-Columbian times and still predominates in regional agriculture. The most extensive research in the world on maize agrobiodiversity is in México where it has been determined that more than half of the total area under this crop, and a much higher percentage in some regions and states, is cultivated with traditional varieties (Smale personal communication 2004, citing Perales *et al.* 1998). Regional analyses of maize genetic diversity and farmer selection have been conducted in different regions: in the State of Guanajuato by Aguirre *et al.* (2000), in the State of Chiapas by Bellón and colleagues (Ibid citing Bellón 1991; Ibid citing Bellón and Taylor 1993; Ibid citing Bellón and Brush 1994), in the State of Jalisco by Louette and colleagues (Ibid citing Louette and Smale 2000; Louette *et al.* 1997), and in the State of Puebla (Ibid citing Perales *et al.* 1998; Ibid citing Van Dusen 2000; Ibid citing Dyer 2002). Such research has focused on temperate upland maize cultivation while little attention has been paid to other agroecosystems, such as the southern subtropics of the Yucatán Peninsula (i.e. Chavez-Servia et al. 2000). These investigations, as well as that on squash and/or beans (i.e. Terán *et al.* 1998; Montes and Eguiarte 2001; Canul *et al.* 2000), have focused on men's agricultural fields (*milpas*) while other production spaces, such as homegardens, which support and enhance the existence and persistence of the *'milpa'* system, have been overlooked.

Homegardens have been found to have a number of adaptive functions over time. For example, relatively large amounts of food are produced with relatively small amounts of labour on relatively small extensions of land that may not be suitable for field crop agriculture. Homegardens provide a 'genetic backstop' during periods of crop failure or disruption, and are places for experimentation with new species or varieties (Niñez 1987). Yucatec homegardens contain an average of 156 cultivated and wild species for food and medicinal uses (García de M. 2000), while providing economic benefits to households and maintaining ethnic identity and traditions (Greenberg 2003).

Worldwide, biases have largely prevented homegardens from being considered as part of the 'productive agricultural' sphere due to their small size and great local genetic diversity, their physical proximity to the household, their often strong association with women's decision-making and labour, and their production of largely non-commoditised cultural and material values (Howard 2003). Moreover, although it is increasingly recognized among researchers in México that women have an influence on male farmers' varietal selection in agricultural fields (i.e. Smale *et al.* 1998), research on crop varietal selection and farmers' preferences has focused overwhelmingly on environmental and agronomic characteristics (genotype x environment interactions), while ignoring a range of cultivar characteristics, uses and preferences that are related to the post-harvest sphere, including storage, processing and culinary characteristics and cultural and ritualistic values, although in other contexts where agrobiodiversity is high these have been shown to predominate. This is supported by a number of case studies. For example, in the Peruvian Andes, centre of origin and diversity of potato and center of maize diversity, Zimmerer's research (1991 cited in Howard 2003) showed that only about 30% of the crop diversity could be explained in terms of

agroecological conditions; 70% was explained by culinary preferences and post-harvest requirements; women are the principle knowledge-holders and their varietal preferences predominate, yet very extensive previous research focused nearly exclusively on men and agroecological considerations (Ibid.). In the Colombian Amazon, a toxic 'bitter' cassava (Manihot esculenta Crantz) varieties are preferred over an 'sweet' non-toxic varieties in spite of the labour-intensive detoxification process that is required. Although high yields and insect resistance of the 'bitter' cassava may influence cultivar selection, it is the foods that can be made from it that constitute the most important consideration (Wilson 1997). In Mali, it was determined that there is a wide range of selection criteria other than the yield and ecological stability that are responsibility for the maintenance of maize diversity, that are related to processing quality (Howard 2003 citing Defour *et al.* 1996). In the Philippines, during participatory testing of sweet potato varieties, women's selection criteria were found to be more quality oriented as they know the consumption preferences whereas men were more market price oriented (Howard personal communication 2004 citing Amalin *et. al* 1991).

1.4 Research objectives

The objectives of the research were:

- To explore how different steps in the production-consumption chain and final forms of uses of maize and squash cultivars influence the decision-making and preferences of men and women and how is this influenced by the gender division of labour in this chain.
- To understand the whether and how the production spaces under study have an interactive relationship in relation to varietal selection.
- To identify the degree of influence that women have over varietal selection decision-making in agricultural fields as men's space and in homegardens as their own spaces, and *vice versa*, the influence of men in homegardens as women's spaces and in agricultural fields as their own spaces.
- To understand how the above are related to gender relations and norms.

1.3 Conceptual framework for the research

Background: ex situ *and* in situ *conservation*

Through selection and cultivation processes, humans have made it possible to increase the biomass of comestible products to a 90% of one acre of land rather than the 0.1% that used to be prior to the appearance of agriculture, about 11000 years ago (Martin *et al.* 2001 citing Diamond 1998). However, as time passed, a greater number of people have come to depend on a minor number of species for food consumption. This is to a large extent considered to be the outcome of the replacement of local crops by a reduced number of 'megacrops' (Ibid citing Brush 2000) which is in turn partly the result of the 'Green Revolution'. This movement originated in the United States between 1920 and 1950 and consisted of the introduction of 'miracle seeds', which were considered as the key to increasing yields in the North and to alleviating hunger and poverty in the South. By the 1970s, those seeds, together with chemical fertilizers, pesticides and, parting many regions, irrigation had replaced the traditional farming practices and local genetic resources of millions of farmers in developed and developing countries. However, by the 1980s the risks entailed in this erosion of crop genetic diversity, particularly in the regions recognized as a centres of origin and diversification of major food staples (see annex) and that such a loss leads to constraints in agricultural development, a worldwide effort was initiated to collect crop

germplasm to be preserved at other places than those of their origin. By the 1980's, a large portion of the estimated diversity of major food staples had been collected at *ex situ* facilities – gene banks, botanical gardens and working collections of crop scientists (Ibid). Around the same time, it started to be recognized the strategic alternative to conserve genetic resources at the places where these have originated and or evolved, this approach is know as *in situ* conservation. Both *in situ* conservation and *ex situ* conservation have been found to be complementary approaches for conservation of genetic diversity (Ibid). (i.e. each one address different aspects of plant breeding; traditional agriculture and genetic diversity are evidently linked) (Ibid). Brush hypothesized that farmers are likely to conserve traditional varieties *in situ* for four main reasons (Howard 2003 citing Brush 1995): 1) land holding fragmentation (several fields with traditional varieties cultivated in at least one of them); 2) marginal agronomic conditions (traditional varieties compete better than improved ones in 'risky' environments); (3) the relative isolation of many traditional farming systems (market imperfections are created so that improved varieties lose their commercial advantages); And 4) farmer's cultural diversity and their preferences for maintaining genetic diversity (they actively maintain traditional varieties). Moreover, *in situ* conservation must be enhanced because: 1) key elements of crop genetic resources cannot be captured and stored off-site; 2) agroecosystems continuously generate new genetic resources; 3) a backup to genebank collections is necessary; 4) agroecosystems in centres of crop diversity/evolution provide nature laboratories for agricultural research, and 5) the Convention on Biological Diversity[4] mandates *in situ* conservation. (Martin et al. citing Brush 2000)

Gender bias in people-plant relationships: reconceptualising the domestic realm

One of the major shortcomings of the *in situ* conservation approach is that there is yet no conceptual framework that takes gender relations into account (Howard 2003). Howard argues that, Although the four reasons for farmers to conserve crop diversity that Brush mentions may be valid (2003:34), that there are still some important missing elements relating to each one of the Brush's points. Regarding point 1, she argues that "men and women often manage different fields, with different responsibilities for providing plant resources and different access to technology, labour, credit, knowledge and markets. The pressures on plant biodiversity in one field may therefore be quite different from those on another field, and for different reasons". This is supported by several in-depth studies (Wilson, Malaza and Woeten in the same volume). As to point 2, "it has frequently been shown that the land to which woman have access for field crop production is more marginal in agronomic terms than that to which men have access''. Regarding point 3:

> Men and women often have access to different markets: women are mainly able to access local markets, where the demand for local varieties is often greater, while men have greater access to urban and national markets, where the demand for modern varieties is higher. Brush does not mention that the fact that production for subsistence is more oriented toward varieties and species that are traditionally consumed in the local diet, and is also often in the hands of women (Ibid.:34).

Regarding the last point, Howard presents a compilation of in-depth studies from several disciplines such as sociology, anthropology, ethnobotany, ethnoecology, plant breeding and women's studies that demonstrate that ''cultural identity, genetic diversity, women and the domestic sphere are clearly interrelated and highly important, and yet are very frequently overlooked'' (Ibid.).

Howard goes on to argue that, in biodiversity rich regions, women manage most of the plant diversity mainly within what is often socially defined as the 'domestic' realm. Howard

[4] Article 8. Convention on Biological Diversity. 1992. Rio de Janeiro, Brazil

elaborates further on the relationship between domesticity and plant biodiversity management:

> The 'domestic' realm is portrayed in contemporary theory as a 'reproductive' sphere where women, as principal agents and managers, carry out unpaid, home-based activities that ensure the maintenance and functioning of people within households. The household in turn, is characterized as the site of principal collective consumption. The reproductive domestic archetype is embedded within the 'cult of domesticity' that prevailed in Europe and its colonies from the 18th-20th centuries. These are features of a powerful systems of ideas that serves to oscure rather than to illuminate those fundamental aspects of contemporary human-nature relations that are the source of social and environmental instability and crisis… …What is characterized as the 'reproductive' domestic sphere, is in reality tremendously productive, albeit largely invisible realm. It contributes the majority of subsistence resources in many rural areas. It involves a highly demanding and holistic level of technical and environmental knowledge and skills related to plants that can require at least a third of a lifetime to accrue, as well as frequent innovation (Ibid:6).

While overlooking the domestic sphere as an area of agrobiodiversity maintenance, the kitchen is as well ignored as the main site of plant diversity conservation, in spite of the fact that it is in the kitchen where the use and continuous cultivation of the widest range of domesticated plant species or varieties is determined. Thus, as women predominate in the use and management of local plant biodiversity, gender relations affect the distribution, maintenance and transmission of local ethnobotanical, cultural and environmental knowledge (Howard Ibid.). Moreover, cultural and biological diversity are strongly interrelated as culture and nature have co-evolved: a place that is rich in biodiversity, is also usually rich in traditions, including e.g. culinary traditions.

Howard identified three main errors that are related to gender bias in ethnobotany, a discipline hat is concerned with 'the study of the interactions of plants and people, including the influence of plant on human culture' (Howard Ibid.:19 citing Balick and Cox 1996:i). The first is an error of *omission* and refers to ''the failure to research women's knowledge and use of plants…the species and varieties that only women know are omitted, and thus biological diversity is underestimated'' (Howard Ibid.:19). The second error refers to *unreliability* and is related to the use of ''sources that are not well informed, which leads to the improper identification of plants, their management, characteristics, uses and names'' (Ibid). This refers to the assumption that men are the most informed sources, whereas they may be ill-informed if it is women who manage certain spaces or species. The third error refers to *interpretation* which ''leads to a misunderstanding of people-plant relations since a critical component – gender relations - is not revealed…by inference, it also stresses the implications of not taking into account gender relations for scientific knowledge, for conservation policies and practices and for women plant managers themselves'' (Ibid:20).

The research here presented is grounded on the above observations, acquired through the supervision and expertise of Professor Patricia Howard at Wageningen University, as well as through my own experience when I was in charge of developing a study focused on the participation of Yucatec Mayan women in the conservation of *milpa* crops as part of the activities of IPGRI's on-farm project in Mexico. While working in Yucatán, my interest in further scholastic training increased due to what I perceived as the lack of appropriate theory, methodologies and instruments to develop and practically apply knowledge about what seemed to me to be obvious: women not only grow the cultivars that they want to grow in homegardens, which are spaces that potentially support production in agricultural fields at least through their agrobiodiversity and as a source of income, but as well women do seem to exercise a strong influence on men's decision making by requesting crop cultivars to be grown in the fields. Thus, by 2001 I indicated my interest to Dr. Devra Jarvis, Global

Coordinator of IPGRI's on-farm project, in obtaining formal education in the area of gender analysis and management of agrobiodiversity that could then be applied in our Mexican research. Since then, Dr. Jarvis has been enthusiastically encouraging and supporting this research.

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Chapter 2: Research strategy and context

2.0 Introduction

This chapter explains in detail the research strategy used for data collection during fieldwork for the research presented in this thesis. The purpose is to provide the reader with an illustration of the overall development and process of data generation which in turn provides insights into the strengths and limitations of the findings here presented. The research strategy should be considered as exploratory, insofar as its purpose was to identify variables and dimensions for further in-depth quantitative and qualitative examination (Verschuren and Doorewaard 1999). Conceptual development and previous empirical research on this topic are at best partial. The chapter starts by giving the reasons for which the village of Yaxcabá in the State of Yucatán, México was chosen as the site of study as well as the reasons for which maize (Zea mays L.) and squash (Cucurbita Spp.) were chosen as crops under study, and continues to explain in detail sampling procedures and the specific methods and instruments used for field data collection as well as the limitations of the study. The next section explains the nomenclature used for the cultivars under study which follows the International Code of Nomenclature for Cultivated Plants (ICNCP) (Trehane *et al.* 1995) rather than the usual format offered by the International Code of Botanical Nomenclature (ICBN) (Trehane *et al.* 1995 citing Greuter *et al.* 1994). Finally, the chapter provides information on the context in which the research was carried out, including a brief political history of the region and the village, a description of agroecological conditions and of the traditional production system, the *milpa ko'o*l, and the spaces conforming it, the *milpas* (agricultural fields), the *solar* (homegarden) and the recent addition of a new production space, the *terrenos* (community plots).

2.1 Selection criteria and sampling

To explore the hypotheses posited at the beginning of this research, it was desirable that a study site be selected that is located within the heart of the maize region of the Yucatan, which is recognized as a centre of origin and diversification of maize, and that the agricultural system be predominantly traditional, employing crops and techniques inherited from Mayan ancestors. The village of Yaxcabá, Yucatán, México was chosen because it met all of these criteria, and in addition the researcher had performed previous fieldwork in the village related to the role of women in seed selection and exchange (Lope *et al.* 2001; Lope 2002).

Maize (Zea mays L.) and **squash (Cucurbita spp.)** were selected for the case study since, while most maize and squash are produced in agricultural fields, the researcher's previous field observations indicated that at least one of the crops, squash, was also found in homegardens[5], although previous research on crop varietal diversity had not reported that these crops were found in homegardens. Further, both species are food staples and therefore varieties are selected every season, so that producers' selection criteria for these crops should be easy to recall. In addition, the two species have many different forms of final consumption, and hence offer the possibility to assess the influence of these forms as well as the post-harvest chain, and both are used both for own consumption and for sale. Maize is used in 40 to 50 traditional dishes while squash is used in about 20, so cultural values around these crops are significant (Cazares and Duch forthcoming). Further, both species have wide range of uses besides food preparation, in part according to different plant parts. Finally, there is a significant diversity of both crops in the study area.

[5]Observations were made during field research in 2001 as part of the researcher's activities within the project 'Strengthening the scientific basis of *in situ* conservation of agrobiodiversity on farm: Mexico country component' (IPGRI-CINVESTAV-IPN). However, this data was neither published nor disseminated.

Households that produce both maize and squash were selected for in-depth research. The **'quota sampling'** method was used to select households and other informants. This method relies on the researcher to decide 'on the subpopulation of interest and on the proportions of those subpopulations in the final sample' (Bernard 1995:94). Special care was made not to select people who were too eager to be interviewed and to avoid those who were difficult to establish contact with. The sampling procedure was implemented only after carrying out a *transect reconnaissance* of homegardens where both maize and squash cultivars were present. The reconnaissance was necessary since the presence of maize and squash in homegardens had not been previously recorded, although they had been recorded in agricultural fields. The reconnaissance consisted of bicycling all through the village from North to South and from East to West while identifying all homegardens where both maize and squash were produced. Both homegardens and these crops were fortunately quite visible at the time of fieldwork (see annex). When household members were present, informal chats were held as a means to obtain an overview of the number of maize and squash varieties usually grown by a given family in homegardens, agricultural fields or in any other production space pertaining to the household. From those families who cultivate a medium to high number of maize and/or squash varieties, male and female heads of household were asked about their willingness to participate in a series of interviews over approximately a three-month period, starting in early August and finishing in early November 2003. The total number of families involved in the final research sample was eight, which represents about 1% of the total number of households in the village.[6] An estimated 90% of the families in the village grow both maize and squash in agricultural fields while only about 12 to 15% were also growing the two crops in homegardens and/or community plots at the time of the fieldwork. The final sample for this qualitative research thus represents about 10% of the households that were producing both maize and squash in agricultural fields and in homegardens or community plots.

In addition to the selected households, four key informants who were reported to have extensive contact with maize and squash genetic diversity in the village were interviewed in relation to specific questions.[7] With only the exception of varietal rankings according to specific selection criteria (see Chapter 4), male and female heads of household from the eight selected families participated in all of the different research phases described below. Regarding the key informants, data obtained from two of them was especially useful for the varietal ranking exercise, and they were also asked the same questions as the eight families during pilot interviews. The collaboration of the third key informant was especially useful to identify non-food uses since he is a renowned healer in the area. Chats with the fourth key informant were used to understand the political organisation of the village, since he is the head of agrarian community (Sp. *comisario ejidal*).

2.2 Methods and instruments for field data collection

Methods for data collection consisted of a triangulation of memory banking procedures for biodiversity selection criteria (Nazarea 2001). Nazarea used these methods to collect qualitative data about management, use and conservation of agrobiodiversity, which are based on methodologies used for Participatory Rural Apraisal (Chambers 1994). 'Rapid apraisal', 'transect walks', 'diagrams and memory maps' and interviews ('history from above', 'history from below') were also used for this research (see below for a description of the type of information collected). These were coupled with other qualitative data gathering methods (varietal listings, prompting, free listings elicitations and varietal rankings) which were used to

[6] The exact number of families in the village is unknown, however, previous research (Interian 2001, Lope 2002; Cazares and Duch forthcoming) estimates about 600 to 650 families in the village.

[7] Chapter 5 provides details about the families interviewed. Regarding the key informants, these included a married couple who are known by villagers as seed marketers and who have collaborated in participatory plant breeding trials, a renowned local healer, and the *ejido* commissioner.

collect information on the gender division of labour and environmental and technical knowledge in the production-consumption chains, and on cultural and material use values associated with the cultivars under study (Howard 2003).

- *Rapid Appraisal (*coupled with informal chats). Upon arrival at the site of study site and prior to the selection of the research sample, informal chats were held with villagers at specific points in the community (i.e. in the central park, at market points, at community events, etc.) as means to gain a first set of insights into the factors affecting the current agricultural cycle and the expected harvest. Around the same time and as part of *rapid apraisal*, a 'transect reconnaissance' (described in the introduction of this chapter) was made to identify the homegardens that contained both maize and squash varieties.

- *Qualitative interviews.* These consisted of six to eight separate sessions per sampled household. Male and female heads of households were interviewed together a few times (in some cases, for the first time as means to build rapport and, during later interviews, as a means to discuss and observe negotiations and interactions between them), but mostly interviews were carried out separately so that each would avoid influencing the other's answers. Interviews consisted of both closed-ended and open-ended questions coupled at times with transect walks in the different production spaces as means to obtain more reliable data. Specific methods were employed as summarized here and described in further detail below. *Free listing elicitations* (asking a question – i.e. about the varieties in a given production area or uses by part of the plant – and making a list of the answers as these are recalled); were employed to quantify diversity and uses, while *diagrams* and *memory maps* (drawings of spaces built from the memory of the people interviewed - i.e. in agricultural fields; see Nazarea 2001) were employed to illustrate the amount and distribution of cultivars by production space (which was done together by the interviewed and the researcher).[8] *Salience ranking* (recalling and recording of elicited comparisons) was performed to compare which variety was considered to be best, regular and not good for a given step within the production-consumption chain*.* A list of specific topics was formulated *a priori* at each interview stage but the line of questioning was flexible and prompting was used in relation to respondents' answers in order to permit exploration of the different topics depending upon the perceptions and experiences of the informants. Interview stages consisted of the following:

    - Demographic information (using close-ended questions). Number of family members and age, education level and main activity of each. Main sources of income for the family, and general characteristics of the house (construction material, water and light services, tenure type, etc.). These data were used to obtain an overall picture of the socioeconomic and demographic conditions of each household that was studied in-depth. Men and women from the eight households were interviewed jointly.

    - Varietal listings. Quantification of maize and squash diversity cultivated by production space (*free listings elicitations* complemented with transect walks in the production spaces when possible); varieties they would like to have and related open-ended questions, and about interactions between production spaces. Men and women from the eight households were interviewed separately.

    - *Memory maps* and *drawings* of amount and distribution of cultivars by production space. For homegardens these were made together with women, for agricultural fields with men, and for community plots with men (F2, F7) and with the man and the

[8] A first attempt was made to have people draw these by themselves but, since this seemed to make them feel uncomfortable, drawings were then done together with the researcher, after a list of varieties by production space had been developed and, when possible, after having made transect walks in the spaces.

woman (F6) (see footnote 3). Men and women from the eight households participated in the exercises.

- Forms of use by part of the plant for both maize and squash. The *free listing elicitation* method was used to enquire with both men and women separately in each of the households in the sample and with key informants about all possible forms of use for the cultivars under question as means to generate an exhaustive list of uses (see annex).

- Gender division labour for production and post-harvest management steps. *Open-ended* and *close-ended questions* were posed to both men and women separately from the eight households regarding who participates in a given step in the production-consumption chain. In some houses, women and men responded separately (F2, F3, F4, F5, F6) but in others they responded jointly (F1, F7, F8). *Prompting* was especially used in this interview stage and consisted of questions regarding gendered norms (i.e. what do people think if you go alone to the fields? does your husband help you? How do others see that?, etc.). Steps in the production-consumption chains were identified by observations thorough the fieldwork but especially during interviews and by available literature (Terán *et al.* 1998; Cazares and Duch forthcoming).

- Varietal ranking. *Salience ranking* was used to compare which variety was best, regular and not good for a given step within the production-consumption chain. Both men and women within the research sample who cultivated the greatest number of cultivars of either of the two crops were first asked which cultivar they considered to be the best for a given step, which was regular and which was less suitable and why. A limitation of such an exercise was that not all of the informants have been in contact with all of the cultivars covered in this study. Rankings were made according to the opinions of a few informants (four men and six women for maize; three men and four women for squash). Rankings were made with the accumulated criteria of those giving their opinions. That is, in the cases were these informants were not able to provide a ranking for a given cultivar since they did not cultivate it, pair-wise comparisons were made with those who do cultivate such cultivars. Men and women were always interviewed separately.

2.3 Limitations of the study

In addition to time constraints, a limitation of the research here presented was that no family was identified during the village reconnaissance as cultivating more than about half if the total amount of the maize diversity that had been previously identified in the village (Burgos *et al.* 2002). This was a notable constraint for ranking of varieties according to different criteria related to the different steps of the production-consumption chain, since none of the men or the women interviewed was able to provide ranking criteria for all of the maize diversity. Such a ranking had to be constructed out of the accumulated criteria of different informants. In spite of such a limitation, all maize and squash diversity identified in the village was included in the rankings.

2.4 Nomenclature for cultivars

Throughout this report, wherever possible, names of the cultivated maize and squash varieties are given according to the International Code of Nomenclature for Cultivated Plants (ICNCP) (Trehane *et al.* 1995) rather than according to the usual format offered by the International Code of Botanical Nomenclature (ICBN) (Trehane *et al.* 1995 citing Greuter *et al.* 1994). This is because the latter is considered to be more suitable when looking at the evolution and hierarchical classification of plants, while the former focuses on human

manipulation and therefore on more linear relationships among plants according to their use and management (van den Berg, personal communication 2004). Principle 2 of the ICNCP indicates that: ''Distinguishable groups of cultivated plants, whose origin or selection is primarily due to the intentional actions of human kind, are to be given epithets formed according to the Rules and provisions of this Code''; and, ''The cultivated plants covered by this Code may arise by deliberate hybridization or by accidental hybridization in cultivation, by selection from cultivated stock, or may be a selection from variants within a wild population and maintained as a recognizable entity solely by continued propagation'' (Trehane *et al.* 1995: 3).

Although it is recognized by the authors of the ICNCP that ''the operations of a system of standards is in its infancy and difficulties may well come to light which may need to be ruled on in later editions of this Code'', that ''more work will be required on the application and use of the cultivar-group'' and that ''working experience may demonstrate the need for more stringent requirements'' (Ibid: xiii), in the context of qualitative research such as that presented here, the ICNCP offers in a more flexible manner the possibility to give an individual identity to each of the cultivars under, study either by using only a cultivar epithet or a cultivar-group designation or by using both. A cultivar epithet can be assigned to "assemblages of individuals grown from seed derived from uncontrolled pollination when they have been selected for a particular attribute that is clearly distinct, uniform and stable in its characteristics and that, when propagated by appropriate means, retain those characteristics'' as well as when those assemblages ''can be consistently distinguished by one or more characters, even though such individuals may not necessarily be genetically uniform'' (Article 2; sections 2.2 and 2.12 of the ICNCP) (Ibid: 6). A cultivar-group designation can be either used together with a cultivar epithet or alone. In the first case, it is added as means to provide information and is particularly useful when a cultivar name is repeated; therefore designations for cultivar-groups may help to establish the differences among such cultivars (Article 4; sections 4.2, 4.3 and 4.4) (Trehane *et al.* 1995).

In the context of the research presented here, cultivar-group designations will be given in some cases as means to provide a clear identity for each of the cultivars under study. This is important as different rankings are given by both men and women for different cultivars where inconsistency in local names may be a confusing factor: sometimes cultivars with a similar genetic make-up but with different phenotypical expressions receive different local names or, *vice versa*, cultivars with distinct genetic make-up but similar phenotypical expressions may receive a single local name (Jarvis *et al.* 2000b). Indeed, values may be given according to either phenotypical traits or genotypical traits or both. Varietal names given in this report are then constituted of the taxon (underlined) followed by either the cultivar-group if present (in brackets), or the cultivar epithet (in single quotation marks), or by both.

2.5 Study site

The study site, the village of Yaxcabá, is located in Yucatán State, Yucatan Peninsula, in southeastern México. Annual temperature in the area remains above 25C and rainfall is uneven (700 mm-1000mm per year) with a rainy season from May to October, sometimes extending to November (Tuxill and Chávez-Servia 2002). Two drought periods typically occur: (1) within the rainy season, lasting 15 to 20 days in August; and (2) during a period with scarce or imperceptible rain from December to April (Ibid). Soils types are quite diverse and are distinguished by colour, stoniness, depth and texture. They are presented in the form of shallow niches within flourished calcareous limestone, in complex associations (Duch 1988).

Traditional agriculture prevails as the main livelihood activity for most of the population, although wage labour and service provision are common and provide a substantial source of

income among the families interviewed. The main crops under regular cultivation are maize (Zea mays L.), beans (Phaseolus vulgaris, p. lunatus, vigna unguiculata), and squash (Cucurbit Spp.).

Yaxcabá is head village of the county of the same name. It is located in the centre of Yucatán State and is linked to the urban centres of Mérida, Valladolid and Cancun through one of the main interstate roads in the Yucatán Peninsula. Yaxcabá County contains 41 agrarian communities[9] (Sp. *ejidos*) composed of about 2500 members and around 3000 farming production units or households (INEGI 2002). Yaxcabá village, as an *ejido,* has an area of approximately 11 000 hectares, with approximately 2 000 to 2 400 hectares cultivated every year (J. Sansores, *Ejido* Commissioner, personal communication 2003).

Background[10]

Since its foundation by the Spaniards around the 1560's, Yaxcabá has been undergone great social, cultural and economical change. Yaxcabá was first under the *'Encomienda'* regime of the Spanish colony, which lasted from 1562 until the end of 18th Century. The village had a protagonistic role in the Indian rebellion that took place in 1761 that expressed the dissatisfaction of the Mayan with the Encomienda's tributary system. By the 19th Century, under the *'Hacienda'* regime but prior to the war between indians and other social and ethnic groups which is known as the Caste war (Sp. *Guerra de Castas*), Yaxcabá became one of the most economically developed villages in the area, with a relatively large number of inhabitants (approximately 16 000) belonging to different social, economic and ethnic groups. However, with the advent of the Caste War, by 1847 the Spanish and mestizo populations were drastically reduced. Native Mayans, mainly from the neighbouring village of Mopila, took Yaxcaba by force since their own village was destroyed in the war. Within the reconstruction of the Yaxcaba, the traditional way of living of Mayan families once again predominated. After a few years of relative calm, social movements were again evident in the area right after the Mexican Revolution (1910). Inhabitants of Yaxcabá rejected the laws proclaimed by the Governor of Yucatan as part of the religious prohibitions that were implemented with the reform of the Mexican Constitution, and inhibitants were in constant struggles with military forces for some years. However, by 1917, Yaxcabans became predominately affiliated to the Socialist Party which at the moment headed the Yucatan government, while Sotuta, the county seat at that time, was dominated by the Liberal Party, which led to a new social movement that ultimately changed the geopolitical status of Yaxcaba. It became a new county, composed of 11 towns with Yaxcabá as the county seat. Nowadays, Yaxcaban inhabitants still are notably divided by social status and political affiliation, where the latter are related to in the two predominant political parties, and where inhabitants relate this with past events as recounted by their parents and grandparents.

2.6 The traditional agricultural system: the *milpa ko'ol*

In contrast to the rest of México where the agricultural system is known as the *milpa*, the Mayan Yucatec refer to their system as the *milpa ko'ol*, where the Mayan word *ko'ol* (maize) as well as the Aztec word *milpa* (agricultural field) together mean 'maize field'. It consists of several parcels that are believed to preserve the ancient Mayan pattern of organisation (Vara 1995; Terán *et al.* 1998) as described in the famous and several times re-edited book *An account of things of Yucatán* by Friar Diego de Landa when he arrived in the New World

[9]An agrarian community or *ejido* consists of a settlement area in the centre surrounded by fields. It can be defined as a socio-political structure underlying the traditional production system which consists of an specific form of land tenure, stipulated by law, in which an individual member has the right to the exploitation of a specific plot of land. The right is not equivalent to ownership of the land. It consists of direct use of the land and the beneficiary or *ejidatario* cannot sell, rent, or mortgage the plot (Branton 2002 citing de Rouffignac 1986).

[10]Historical data summarised from Padilla (1983).

around 1566 (Baeza *et al.* 2003). Each parcel can also be divided into different sub-areas, each of which is characterised by specific production patterns and techniques. Among such spaces, those that are traditionally 'required' for any farming family or household are the homegarden (Sp. *solar*) and the agricultural field(s) (*milpa ko'ol*). Indeed, it is in these two spaces where gender relations within the production system are most clearly manifest, where homegardens are considered to be women's production space and the agricultural fields are men's production space. In addition to these two traditional spaces, a 'new' production area seems to have emerged during recent times where gender norms seem to be less bounded by tradition. This production space is referred in this research as the community plot (Sp *terreno*), which consists of community land that has been distributed to some families for future use according to village spatial planning and population growth.

2.6.1 Agricultural fields (*milpa ko'ol*)

Mayan agricultural fields are also often called simply 'milpas'. These are cultivated by intercropping maize, beans and squash using swidden techniques, with no mechanisation and where all production is rainfed. Two types of traditional agricultural fields are found: 1) the *milpa roza*, a field with an 12.4 years rotation fallow; and 2) the *milpa caña*, a field with an average of a five-year rotation (Interian 2001). Agricultural field production is mainly subsistence-oriented. Agricultural fields are measured and subdivided into *mecates*, an ancient Mayan measure consisting of 20x20 meters (.04 ha). The size of fields may vary from a few *mecates* to four or five hectares. Any given field is likely to have at least two different types of soil which the Maya classify into eight main soil types (see Duch 1988). Spaces for other horticultural crops are also found within agricultural fields but are separated from maize and its associated crops. Agricultural fields are traditionally considered to be a male production space.

2.6.2 Homegardens *(solares)*

Homegardens have a higher diversity of species than agricultural fields despite its relatively small extension in comparison to the fields. According to Vara (1995), the homegarden has a sequential cropping pattern. Old vegetation areas (Mayan *hubché*) are removed in order to plant areas for common bean cultivation (Mayan *chac bi pach*) and multicropping of short cycle maize, squash and beans. After these areas are harvested, the soil is then prepared for both annual and perennial horticulture species (Mayan *pach pakal*). Annual and perennial horticultural species then become the two most persistent cropping forms in any well-established homegarden, where small animal production is also considered as a main activity (Lope & Chavez 2001).

Homegardens are usually referred as *solares* (pl.) in all of Mexico and Latin America. In addition to being recognized as *in situ* gene banks due to the high diversity of plant species found in this space (Greenberg 2003; García de M. 2000), homegardens may serve as experimental stations, that is, the place where new plant genetic materials and cultivation techniques are tried before sewing in fields (Niñez 1987). Homegarden have also been found to have a number of adaptive functions. For example, it has been asserted that theyproduce relatively large amounts of food with marginal labour on relatively small extensions of land, that may not be suitable for field agriculture, and provides a backstopping during periods of crop failure or disruption. In Mayan homegardens, most or all of the labour force is usually provided by women, children and the elderly (Perez 1983). As women are the main decision makers in this productive space, they are also likely to be responsible for most varietal selection. Yaxcabanian women cultivate species that 'do not requite a lot of work' such as onions, coriander, chilli peppers and fruit trees (Morales and Quiñones 1999).The amount of inter-specific variety commonly found in homegardens in the Yucatán (156 species on average - García de M. 2000) is also substantially higher than that found in agricultural fields (a maximum of 25 species between crop staples, fruit trees and legumes – personal observations; with 22 intra-specific varieties of maize –Gómez *et al.* 2001).

2.6.3 Community plots *(terrenos)*

The production space here identified as the 'community plot' seems to have proliferated in the last three years when the village council began to allocate small parcels to certain residents as part of the planning for future population growth in the village. For the families who are allocated these plots, the land is supposed to be given to sons who may marry in the future and meanwhile is used for cultivation. In spite of the fact that the reasons for allocating land and the way that it occurs do not seem very clear, this space is described in this section because, as further chapters will show, these are important new production spaces for crop diversity in the village.

Community plots seem to differ in cropping pattern from homegardens, and in comparison with homegardens, are predominately organized as a kind of 'mini-agricultural fields'. That is, generally maize is intercropped with squash and bean (Phaseolus vulgaris, P. lunatus, V. unguiculata) plus small areas with other 'agricultural field cultigens' such as yam (Dioscorea spp.) and cassava (manihot esculenta Crantz). This production space cannot be considered as predominately male or female since both men and women seem to equally participate and make decisions in this space.

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Chapter 3: Encountered maize and squash diversity and the interaction among production spaces

> She needs to know about maize…she is now 11 years old and we don't know who she is going to marry tomorrow…maybe he leaves [migrates] and she will need to have maize to feed her and her children…so she better learn about maize now that she is young…(Yaxcabanian male farmer).

3.0 Introduction

This chapter discusses the interaction among the main production spaces – homegardens, agricultural fields and community plots - that make up the agriculture system of contemporary Yucatec farming families in the study area, and how these interactions enhance the maintenance of maize and squash cultivar diversity for the population under study. Such a system is based on ancient Mayan cultivation patterns that have evidently undergone socio-technical transformation and adaptations. Even in the contemporary system, productive relations between men and women and their dynamics have supported the maintenance of highly valued crop genetic diversity from generation to generation.

Men and women heads of household were first asked which maize and squash cultivars they were currently cultivating in the production spaces that pertain to their households with the objective of identifying the diversity maintain by each family and where it is located. Memory maps and drawings made from transect walks were then elaborated together with the informants as a means to identify which varieties are grown in larger or lesser amounts and where. Later, men and women were asked questions regarding their reasons for maintaining such cultivars as well as why they cultivate them in a given space. This included further qualitative probing and questions such as who has sown the cultivar in a given space and who takes care of the plants. Conclusions suggest that maize landraces are predominantly, although not exclusively, cultivated in agricultural fields due to the large areas required, and cultivar preferences stem from a number of qualities, from cultural to agroecological. For squash, all identified cultivars are landraces and preferences for cultivars and spaces seem to be more related to the specific characteristics of each cultivar (i.e. specific uses of each cultivar and the care that can be provided in a given production space). Maize could be considered as a mainly men's crop as it is the key food staple for the community and larger amounts of it are grown in the male production space where women do not have free access. Women only have free access to limited amounts of maize grown in homegardens and community plots. In the case of squash, at least the cultivar 'Tzol' could be considered as a women's variety since it has not been found in men's agricultural fields and, due to need to care for the plants, women are in charge of plant management in spaces accessible to them. As to the other squash varieties, although some of them require as much care as 'Tzol' and have been found in production spaces that women can freely access, as far as the outcomes of this study can demonstrate, these cannot be considered as either exclusively male or female varieties.

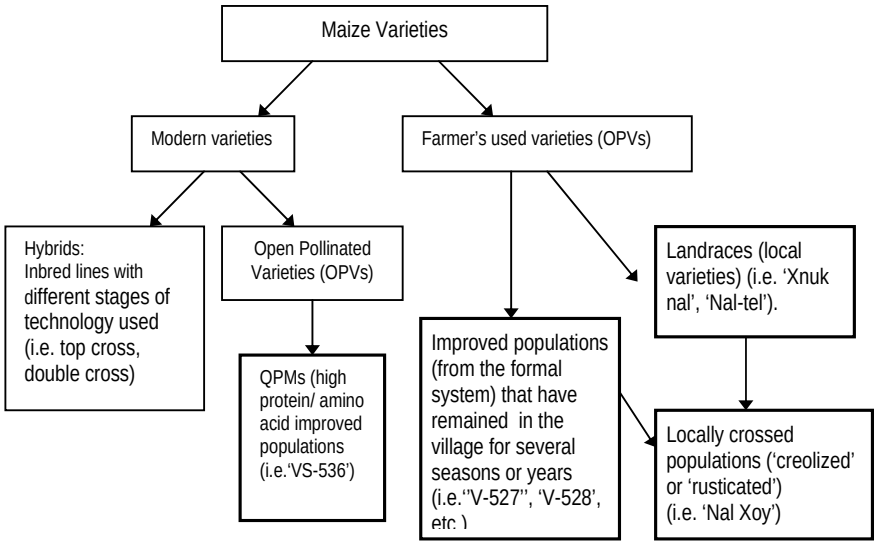
3.1 Types of cultivated maize and squash varieties[11]

Based on the categorisation of types of maize varieties and their physical features made by Song (1998); on the classification of maize populations according to breeding history and the

[11]As discussed in Chapter 2, variety naming in this report is presented according to the International Code of Nomenclature for Cultivated Plants (ICNCP) (Trehane *et al.* 1995). Variety names consist of the taxon (underlined) followed by either the cultivar group (if present) or the cultivar epithet (in single quotation marks), or by both. Non-italic font is used for foreign words in epithets since names have been previously published in other works in the same form.

resulting categorization from the combination of such classes made by Aguirre et al. (2000)[12] and; on previous agromorphological characterisations made for regional maize in the Yucatan region (Burgos et al. forthcoming; Chavez-Servia et al. forthcoming; Chavez-Servia, personal communication 2004) the maize diversity encountered in this report is presented as 1) landraces, 2) locally crossed populations, and 3) improved populations (Figure 3.1)[13].

Figure 3.1 Major categories of maize populations (adapted from Song 1998)



* Highlighted boxes contain the types of varieties present in the area under study.

Sources: Song 1998; Aguirre, Bellon & Smale 2000; Burgos et al. forthcoming; Chavez-Servia forthcoming.

In the case of squash, varieties grown in the area have all been previously identified in agromorphological characterisations as landraces (local varieties or farmer's varieties) (Canul et al. 2001; Canul et al. 2002).

3.1.1 Landraces (local varieties)

Landraces are considered as primitive cultivars (van den Berg, personal communication, 2004). The term 'landrace' has been defined as 1) "a local population with certain characteristics that often include strong local adaptability and local stress tolerance. It typically has lower yield[14] but normally a good quality and other characteristics suited to the local preference. They are an important source of breeding material. Effectively managed

[12]By combining the classes of maize according to breeding history (modern varieties, landraces and creolized varieties) any sample of ears collected from a variety grown by a farmer could be categorized as 1) a pure race; 2) a racial mixture; 3) an improved variety; or as 4) a creolized or rusticated variety (Aguirre et al. 2000).

[13]Although people in the village referred to the varieties introduced by the formal breeding system as 'hybrids', this group of maize does not consist of hybrids. These varieties ('V-527', 'V-528' 'V-532', 'V-533' and a recently introduced high protein variety 'VS-536') are indeed genetically known as 'multilinear varieties' or 'synthetic varieties' which are the product of the composed breeding of hundreds of different 'lines' (from diverse origins or combination of varieties and races) over time (Chavez-Servia, personal communication, 2004).

[14]Chavez-Servia says that this may not always be the case. In some cases, landraces perform better than formally improved varieties or it may be the case that the latter are not present (Chavez-Servia, forthcoming).

and maintained by farmers" (Song, 1998: 80); as 2) ''crop populations that have become adapted to farmer's conditions through natural and artificial selection'' (Aguirre et al. 2000: 61), as 3) "populations or races that have become adapted to farmer's conditions through natural and artificial selections'' (de Boef 2001: 222 citing Thurnston et al. 1999); as 4) "a crop variety bred and cultivated by farmers and adapted to local environmental conditions'' (Jarvis *et al.* 2000b: 10); and as 5) "a term favoured by scientists and seed professionals to indicate the particular kinds of old varieties that are farmer-selected in areas where local subsistence agriculture has long prevailed… a term most accurately applied to the local varieties of corn, squash, and beans, for instance, that were domesticated by native farmers, and further modified by native and also immigrant farmers'' (Murfreesboro 2002). Landraces are also referred to as *criollos* (Sp.), local varieties and farmer's varieties.

3.1.1.1 Maize (Zea Mays L.) landraces

In the Yucatan, the Pre-Columbian races of Zea Mays L. Tuxpeño, Dzit-bacal and 'Nal-tel' have been recognised as landraces (Wellhausen et al. 1951 cited in Burgos et al forthcoming; Sanchez et al. 2000). Such races present wide inter- and intra-racial diversity which indeed gives place to other Zea Mays L. cultivars or cultivar-groups due to the nature of open-pollenisation breeding. That is the case of the cultivar named by local curators as Xmejen nal, an intermediate group with grain characteristics typical of 'Nal-Tel' but which matures later (Burgos *et al.* forthcoming).

Zea Mays L. Tuxpeño in Yucatan is apparently not related to the Tuxpeño seed releases by CIMMYT that took place during the 1970's and that has served as progenitor of new maize diversity all around the world.[15] According to the INIFAP catalogue of maize varieties distributed in Mexico since 1960, it is never mentioned that either a race or variety named as Tuxpeño has been distributed in the Yucatan region (Gámez *et al.* 1996). The Yucatecan Tuxpeño -actually referred to by local curators as Xnuk nal- has been recognised in plant breeding literature as belonging to the Tuxpeño racial group due to the encountered similarities in characteristics between this Mexican landrace and the Yucatecan Xnuk nal, according to the report made by Wellhausen et al. about the maize races of Mexico (Sanchez et al. 2000 citing Wellhausen et al. 1951). More recent morphological and isozymic analysis have also supported the classification of Xnuk nal as Tuxpeño belonging to the "Tropical Dents Group", adapted to medium to low elevations (0-1700 m), and having from 18 to 27 tassel branches and long and cylindrical ears with 12 to 16 rows of deeply dented kernels (Sanchez *et al.* 2000).

According to previous research focused on seed exchange systems carried out in the community under study, 63.6% of the maize varieties available in the community consists of landraces (14 varieties out of a total of 22) (Gómez *et al.* 2001). Kinship and social networks have been especially important for the maintenance and flow over time of such varieties in the study area. Exchange is done through different mechanisms such as seed swapping, cash payment, gift and theft. However, seed exchange is more likely to occur through payment in cash, while gifts are limited to closely related farmers such as neighbours and friends (Ibid).

3.1.1.2 Squash (Cucurbita moschata (Duchesne ex Lam.), C. argyrosperma Huber, and C. pepo L.) landraces

As indicated above, all squash cultivars found in the study area are landraces (Canul *et al.* 2000; 2002). As in the case of maize landraces, seed exchange has played a primary role in

[15]The most representative samples of the 'Tuxpeño' released world wide by CIMMYT are 'Oax. 9', 'Ver. 39' and 'Ver. 128' (Ortega *et al.* 1991). Other known releases are 'Tuxpeño 1' and 'Tuxpeño PBC15' identified as two improved populations developed by CIMMYT from a landrace originating in Tuxpan, Mexico, which were introduced for instance in China by 1978, where they have become popular maize varieties today (Song 1998).

the maintenance of squash varieties over time. Seed exchange for this crop occurs through the same mechanisms as that for maize landraces (Gómez 2002), although exchange networks per squash variety are more gender-specific than in the case of maize irrespective of whether these are grown in agricultural fields or homegardens.

3.1.2 Locally crossed populations

A 'locally crossed', 'creolized' or 'rusticated' variety consists of a maize population that originally was an improved variety (originated in the formal breeding system) but that, given open-pollination, has been under farmer management for several seasons and has mixed with local maize populations either through deliberate farmer practice or through natural out-crossing (Aguirre *et al.* 2000). Local crosses are mainly done through 'mass selection' (where the female parent is controlled), the most basic traditional method of plant improvement and the most popular method for breeding used by farmers which gains the attention of scientists due to the wide genetic base and relatively broad adaptability and stability it represents (Song 1998). It also occurs under free recombination as a product of cross-pollination (Chávez-Servia, personal communication 2004).

In the Yucatan region, the maize variety known as Zea Mays L. 'Nal Xoy' = 'Nal-tel' x 'PR-7822' can be classified as a locally crossed variety. 'Nal Xoy' is the creation of a local farmer from the village of Xoy, Yucatan who has a good reputation in his town and surroundings. He first obtained the seed in 1983 by crossing a CIMMYT improved variety and a landrace. The locally crossed variety 'Nal Xoy' is today recognised in the region for its high pest resistance and high yields which the farmer-breeder believes provide greater food security (Bellon 2002). In the village under study, 'Nal Xoy' was first introduced by staff from CINVESTAV-IPN around 1998 to a few farmers in the village.

3.1.3 Improved populations

An improved population or variety is a product of formal plant breeding that is selected by scientists for certain characteristics such as high yield, short stature or good response to fertilizer (Aguirre *et al.* 2000). Advantages in agronomical performance of improved populations over landraces (and even over hybrids when these are present) have led to the popularity of these populations in environmentally harsh regions (Song 1998).

The results of formal maize improvement in the Yucatan have been relatively weak. For instance, from 1956 to 1990, no more than five maize varieties were released for the region, which were not appropriate for the stony soils of the Yucatan where it is not possible to mechanise agriculture (Chávez-Servia forthcoming citing Márquez 1992). However, these varieties seem to be present in the village under study. In addition, a high protein material (QPM) known as 'VS-536' has been recently introduced in the area (Castillo, personal communication 2004). These varieties are referred to in the present research as the Zea Mays L. Imported group according to ICNCP (van der Berg, personal communication 2004), with the cultivar-group that consists of 'V-528', 'V-530', 'V-532', 'V-533', 'V-534' and 'VS-536'.

Hybrid varieties differ from improved varieties in that the former consist of either two, three or four inbred lines that give rise to a homozygote, while the latter can consist of hundreds of parental lines (Song 1998). Both hybrids and recently developed improved varieties, such as the ''QPM's'' or varieties with high protein or amino acid contents, are known as 'modern' varieties. Hybrid varieties are the most unstable of the modern varieties. This is because their genetic identity is easily degenerated and farmers are unable to replicate the inbred lines (Chávez-Servia personal communication 2004).

3.2 Diversity encountered during the 2003 harvest season and reasons for its maintenance

3.2.1 Maize

Villagers make a general distinction between the maize varieties that have been introduced into the community and those that are considered to be native, where the former are referred to as 'hybrids' and sometimes as 'improved' (although all of them are actually 'improved populations'), whereas the latter are called *payis* (Mayan) As indicated before, due to the nature of cross-pollenisation, the maize cultivars that were encountered genetically may not be truly improved populations nor truly *payis*. In addition, it seems to be quite difficult for farmers, especially for women, to make a distinction between or identify by names the different introduced maize varieties. They call all of them 'hybrids' (in spite of the fact that these are not hybrids). Only those farmers who have been working closely with extension agronomists or researchers are able to make distinctions among the improved populations. For example:

> …A few years ago I was growing 'V-532', 'V-527', and 'V-528' but none of these had a good husk cover. This year we have available 'VS-536'….. Perhaps the husk cover is better in this one…(Don Celso Cob, Yaxcabanian male farmer who has collaborated for more than five years with several projects operating in the area and a key informant for this study).
>
> About five years ago, I was sowing a yellow variety that I think is called 'V-527'…It produced a good harvest but I don't have the seed any more… Another time I tried one that a 'Chapingo'[16] gave to me…I am not sure if it is 'V-533' or 'Nal Xoy' (Don Fernando from family six, Yaxcabanian male farmer who has been active within the *Comisaria Ejidal* for many years).

The case of the *payis* (landraces) clearly contrasts with that of improved populations. Both men and women are quite knowledgeable about the differences between and within local varieties. As both men and women frequently stated, "'it is *our* maize", suggesting a strong proprietary sense and perhaps a sense of cultural identification with these varieties. Thus, implicitly it shows the importance of continuing to cultivate such landraces in spite of the fact that some varieties are grown by more families than other varieties (Table 3.1), as further data will show.

Table 3.1 offers an overview of the maize varieties encountered and how often these were found in the research sample. Although this research did not intend to assess the gender differences in cultivars naming, it is appropriate to mention that the prefix 'X' frequently used in local taxonomy has a feminine connotation in the Mayan language (Bolles 2003). In addition, Mayan farmers name their maize varieties according to cycle and colour (Jarvis et al. 2000b citing Arias et al. n.d.).

Reasons mentioned for cultivating specific maize varieties were quite diverse and consisted of the following categories:

- Aesthetics
- Cultural and family values
- Experimentation
- Food processing and preparation
- Marketing
- Organoleptic characteristics (taste, smell).
- Production (agromorphological and agroecological) characteristics

[16]With this term, Yaxcabanians refer to all of the researchers and students from the University of Chapingo (one of the two most renowned agricultural universities in Mexico) who are interested in studying agricultural field dynamics in the community.

- Specific forms of food
- Storage.

Below, each cultivar is itemized and information about it is disaggregated by sex of the informant, where information is further summarized in tables. Due to the qualitative and exploratory nature of this work, a reason for cultivating a particular variety mentioned by only

Table 3.1 Encountered maize (Zea mays L.) varieties, 2003 harvest season

Cultivar group	Cultivar name(s)	Length of time present (years)*	Families	Production space		
				H	CP	AF
Xnuk nal (a landrace)	'Sac nal' (white)	4-5	F1			X
		9	F2			X
		77	F3			X
		65	F4	X		X
		50+	F5			X
	'Can nal' (yellow)	77	F3			X
		65	F4			X
		50+	F5			X
		10+	F6			X
		45	F7		X	X
		10	F8			X
	'Xhe ub' (purple)	65	F4			X
		10	F8	X		X
	'Xgranada' (reddish)	10	F8			X
Xmejen nal (a landrace)	'Can nal'; 'Xtup nal' (yellow)	10	F1	X		X
		9	F2		X	
		47	F3	X		
		1st year	F6	X	X	X
	'Sac nal'; 'Xtup nal (white)	65	F4	X		
		1st year	F6		X	
	'Chac nal'; 'Xtup nal' (reddish)	1st year	F6		X	
	'Xhe ub' (purple)	2	F1			X
Imported group		1st year	F1	X		X
		1st year	F2	X		
		1st year	F7	X	X	X
		1st year	F8	X		
'Nal-tel' (a landrace)	'Nal tel '; 'Enano' (yellow); ''Dwarft'' (Sp. *'Enano'*)	1st year	F1			X
		47	F3	X		
		1st year	F5	X		
Dzit-bacal (a landrace)	'Blanco colmillo' (white)	26	F8	X		X
	'Amarillo colmillo' (yellow)	26	F8	X		X
	'Beckech bacal'	2	Key informant			X
'Nal Xoy' = 'Nal tel' X 'P7822' (a local cross)		5	Key informant			X

* The number of years is approximate, according to the farmers' responses
In bold font are the most frequently grown varieties.
H= Homegarden, CP= Community plot, AF= Agricultural field.

one person is considered as equally important as a reason that was mentioned by many people, and therefore reasons mentioned are not presented by frequency.

3.2.1.1 Zea Mays L. Xnuk nal

According to the data presented, the predominant maize cultivar group in the study site is the landrace Xnuk nal [(Mayan) *Xnuk*: long cycle; *nal*: maize], which is referred to in plant breeding literature as belonging to the landrace group that originated at Tuxpan, Mexico (Tuxpeño) due to the agromorphological similarities with this racial group first identified by Wellhausen et al. in 1951 (Sanchez et al. 2000) and more recently by other specialists in the

field (Ibid). The Tuxpeño or Xnuk nal race[17] shows a wide intra-specific diversity expressed in a range of grain colours from white [(Mayan) 'Sac nal' (actually a very pale yellow) to purple-almost black [(Mayan) 'Xhe ub']. However, the most commonly seen varieties were the white and the yellow. Although these expressions are usually found in the regular 4-month cycle, both were also found in 2.5 and 3.5 month cycles (F4). In addition, a Zea Mays L. Xnuk nal 'Sac nal' of with a three month cycle was also found (F1). Two other Xnuk nal varieties - the four month purple or 'Xhe-ub' and the reddish or 'Xgranada' variety were found only in one family's holdings (F8). Specific reasons for cultivating the variety were given mainly for the purple expression rather than the red, as this family considers the latter to be similar to the yellow or 'Can nal' variety. Table 3.2 summarizes reason given for cultivating each variety grouped by cultivar without considering differences in maturation time.

Table 3.2 Reasons for cultivating Xnuk nal

Cultivar	Cultural values		Specific forms of food			Marke-ting	Organo-leptic	Processing & preparation		Production characteristics				Stora-ge
Xnuk nal	a.	b.	a.	b.	c.	a.	a.	a.	b.	a.	b.	c.	d.	a.
'Sac nal' (white)	M	M	MF			F		F	F	M	M			
'Can nal' (yellow)							MF		F				M	
'Xhe ub' (purple)	M		MF	F	F	MF				M				M
'Xgranada' (reddish)	M									M				M

The informants gave the following responses:

- *Cultural and family values:* (a) Seed has been with them for a lifetime. This means that seed was inherited [(Sp.) 'era de mi padre'; 'era de mi abuelo']; (b) "It is our maize, the maize from our region".
- *Specific forms of food:* (a) "It is the best for *tortillas*" (referring to consistency and taste); (b) "The *tortilla* becomes pink and has a very special taste we like very much"; (c) ''It is the best one for (Sp.) *Relleno negro* relish; if other maize is used it becomes whitish''. (*'Relleno Negro'* is the favourite dish for celebrations and special occasions).
- *Marketing:* (a) ''It can be sold for a good price''; "Many people in the village know that we have it and stop by our house to buy it".
- *Organoleptic characteristics:* (a) "It has a very nice taste".
- *Food processing and preparation:* (a) ''The dough [(Sp.) *masa*] requires less water'' and therefore ''it is easier to shape the tortillas''; ''Nice dough consistency''; ''The dough is soft''; (b) "It does not become 'soupy''' [(Sp.) 'no se pozolea']. This means that, when the grains are boiled prior to grinding '*nixtamal*' (Mayan), the grain retains its shape and consistency, a quality needed for good maize cake [(Sp.) '*tortilla'*] processing.
- *Production characteristics:* (a) "Plants are strong"; (b) ''Drought resistant"; (c) ''Grains have a 'floury'[18] consistency''; (d) 'Grains have a 'flint' consistency''.
- *Storage: "*Grains do not get pitted'' [(Sp.) *'no se pica'*].

3.2.1.2 Zea Mays L. Xmejen nal

Next to Xnuk nal, the landrace Xmejenal [(Mayan) '*Xmejen',* meaning short cycle)] also called 'Xtup nal' [(Mayan) *'Xtup',* meaning small, short)] was more frequently found in a yellow expression (F1, F2, F3, F6) than in the white (F4, F6), the red (F6) and the purple (F1) expressions. The yellow was found in both the 2 month cycle (F1, F2, F3) and 2.5 month (F4, F6) cycle. The white, red, and purple expressions were found in the 2.5 month cycle (F4 and F6, F6, and F1, respectively). No strict differences were made between colours among the other expressions. Table 3.3 summarizes the reason given for cultivating Xmejenal.

[17]According to isozymic and agromorphological analysis, Tuxpeño and Xnuk nal indeed belong to a single cultivar-group. However, in this work it is referred to as Xnuk nal since this is the local name.
[18] The terms 'floury' and 'flinty' refer to two types of kernel (post-harvest) according to the Descriptors for Maize (IBPGR 1991).

Table 3.3 Reasons for cultivating Xmejen nal

Cultivar	Aesthetics	Specific forms of foods				Processing & preparation	Production characteristics
Xmejen nal	a.	c.	d.	e.	f.	c.	e.
'Sac nal' (white)			F	F	F	F	MF
'Can nal' (yellow)			F	F	F	F	MF
'Chac nal' (red)			F	F	F	F	MF
'Xhe ub' (purple)	M	F					

The informants gave the following responses:

- *Aesthetics:* (a) ''Because of its colour…. It is like the usual *'Xhe ub'* but it is available in less time".
- *Specific forms of foods:* (c) ''It is the best one for (Sp.) *Relleno negro* relish; if other maize is used it becomes whitish''. (*'Relleno Negro'* is the favorite dish for celebrations and special occasions); (d) "It is the best one to eat boiled while young …..it is very soft and tasty"; (e) "It has a very special taste for thick maize pancake [(Mayan) *'iswaaj']"; (f)* ''It is the best for young kernel beverage [(Sp.) *'Atole nuevo']".*
- *Food processing and preparation:* (c) "Can be ground in a hand-grinding machine". This means that is not necessary to spend both time and money in going to the mill.
- *Production:* (e) "It is the first maize to harvest". This means that, due to the earliness of this race, it can be available before the main harvest time - the harvest of Xnuk nal -. Xmejen nal is actually not the ''first maize to harvest'' which indeed is 'Nal tel'. However, Xmejen nal is by far more frequently found in the village than 'Nal tel'.

3.2.1.3 Zea Mays L. Imported group

Following the Xmejenales in frequency are the improved varieties, herewith referred as to the Imported group according to the ICNCP guidelines. As mentioned earlier, men and women in the village usually refer to the improved varieties as if they were a single variety (except for the previously-mentioned two persons). Therefore, all are investigated and analyzed as a single population. All of the families having improved varieties have introduced them only recently.[19] Reasons for cultivating these varieties are summarized below.

Table 3.4 Reasons for cultivating Imported group

Cultivar	Specific forms of food	Production characteristics			
Imported group	g.	f.	g.	h.	i.
'V-527', 'V-528', 'V-532', 'V-533', 'V-534' or 'VS-536'	F	M	M	MF	MF

The informants gave the following responses:

- *Specific forms of food:* (g) ''It is good for the beverages [(Sp.) *'pozole'* and *'atole'*]".
- *Production characteristics:* (f) ''Just to try it''; (g) ''Gives two maize ears while other maizes like Xnuk nal give only one''; (h) ''Can give two harvests in a year''; (I) ''It is what is available, so one should grow it and use it''.

3.2.1.4 Zea Mays L. 'Nal tel'

One of the maize cultivars rarely found in the village is 'Nal tel', a Pre-Columbian race that has received attention from international researchers since it has been recognized as one of the major maize genetic resources dating from the Classic Mayan period (325 to 925 A.D.)

[19] Ix Nahuat (2002) demonstrated that introduced improved crop varieties are usually kept for only one or two cycles as these are not likely to resist drought, pests and predators, and storage life is short. However, he further indicated that, in the case of improved and creolized maize varieties, Yaxcabanians do try to conserve some of them because of some specific characteristics such as maturation cycle, agroecological adaptation and ear characteristics.

which further was related to the flourishing of Mayan Civilization since it had an excellent yield at that time (Brewbacker 2000). This is also acknowledged by local seed curators today:

> … It is said that, a long time ago, there was only one seed to sow… and that it gave high yields…but somebody brought many, many different seeds…and now as a penitence we have to sow many seeds… (Don Mauro, August 9, 2003, Event for the International Day World's Indigenous People celebrated in Yaxcaba, Yucatan)

In addition to being considered as the ancestor of other maize varieties that appeared after the Classic Mayan period (Chavez-Servia, personal communication 2004), 'Nal tel' has also been identified as a threatened landrace with a ''rare frequency over extended areas'' (Ortega, n.d.: 19). In this research, 'Nal tel' was only found in its yellow expression (F1, F3, F5), which is actually reddish coloured and is thus referred to by local curators to as *''rojito''* (Sp. - little red). However, according to a genetic characterization made in the area (Burgos et al. forthcoming), it seems that it consists of the same yellow 'Nal tel'. People in Yaxcaba are quite aware of the difficulties of finding 'Nal tel' seed; however, on several occasions both men and women mentioned that it would be good to have the seed for this variety (F6, F7). Reason to maintain the only encountered expression of 'Nal tel' are summarized in Table 3.5

Table 3.5 Reasons for cultivating 'Nal tel'

Cultivar	Organoleptic characteristics	Processing and preparation		Production characteristics
	a.	a.	d.	i.
'Nal tel' (yellow)	F	F	F	MF

The informants gave the following responses:

- *Organoleptic characteristics:* "It has a very nice taste".
- *Processing and preparation:* (a) "The dough [(Sp.) *masa*] requires less water'' and therefore ''it is easier to shape the tortillas''; ''Nice dough consistency''; ''The dough is soft''; (d) ''Easy to degrain''.
- *Production characteristics:* ''It is ready in seven weeks''.

3.2.1.5 <u>Zea Mays L.</u> Dzit-bacal

The Dzit-bacal cultivar-group was found in this research both in its white and yellow expressions (F8). In addition, there was a variety with an extremely thin cob that was collected in Cantamayec (a village about 90 kilometres from Yaxcaba) and given to Don Celso (key informant) about two years ago by staff from CINVESTAV-IPN. This Dzit-bacal cultivar is called 'Beckech-bacal'. The reasons for cultivating a Dzit-bacal are summarized below:

Table 3.6 Reasons for cultivating *Dzit-bacal*

Cultivar	Aesthetics	Cultural values	Experimentation	Processing	Storage
Dzit-bacal	b.	a.	a.	a.	a.
'Blanco colmillo' (white)	M	M		F	M
'Amarillo colmillo' (yellow)	M	M		F	M
'Beckech bacal'	M		M	F	

The informants gave the following responses:

- *Aesthetics:* (b) ''Its very thin cob looks very nice''.
- *Cultural and family values:* (a) Seed has been with them for a life-time. This means that seed was inherited [(Sp.) 'era de mi padre'; 'era de mi abuelo'].
- *Experimentation:* (a) ''To cross it with *'Nal Xoy'* and have a white *'Nal xoy'.*

- *Processing:* (a) ''The dough [(Sp.) *masa*] requires less water'' and therefore ''it is easier to shape the tortillas''; ''Nice dough consistency''; ''The dough is soft''.
- *Storage:* (a) ''Grains do not get pitted'' [(Sp.) *no se pica*].

3.2.1.6 Zea Mays L. 'Nal Xoy' = 'Nal tel' X 'PR7822'

The cultivar 'Nal Xoy' is a local cross that has increased in popularity in the region and that has attracted the attention of maize researchers and other groups, especially those concerned with participatory plant breeding. 'Nal Xoy' is the creation of a farmer from the village of Xoy who has a good reputation in his town and surroundings. He first obtained the seed in 1983 by crossing a CIMMYT improved variety 'PR7822' and 'Nal tel', and the local cross is now recognized for its high pest resistance and high yields, which the farmer-breeder believes provide greater food security (Bellon 2002). In Yaxcaba, 'Nal Xoy' was also introduced about five years ago by staff from CINVESTAV-IPN to a few farmers in the village. Nowadays, it seems that only one person cultivates 'Nal Xoy' in sufficient quantity to consume and to sow, in spite of the fact that some people in the village indicated that they would like to have the seed (Tonino, F2; other villagers). The reasons for the only couple (Don Celso and Doña Paula Cob, Key informants) found cultivating 'Nal Xoy' are presented in Table 3.7.

Table 3.7 Reasons for cultivating 'Nal Xoy' = 'Nal tel' X 'PR7822'

Cultivar	Production (agromorphological and agroecological) characteristics.		
	a. "Plants are strong"	b. 'Drought resistant".	g. ''Gives two maize ears''
'Nal Xoy'	MF	M	MF

3.2.2 Squash

The case of squash is quite different from that of maize, as squash varieties grown in the village are all landraces or *payis*. Thus, no discrimination is made between varieties that are *'of us'* and those that are not. Each variety is highly valued as a single component of the traditional system. Table 3.8 gives an overview of the squash (Cucurbita) cultivars found according to family and production spaces.

As previous research has indicated (Canul et al. 2002), local names show a high correlation with number of days to either female or male blossom and length of time to harvest. Reasons presented below for cultivating a given squash cultivar corroborate the findings for three out of the four squash cultivars here presented by Cazares et al. (2002) in a study of culinary characteristics of local crops. Such findings suggest that each of the cultivars has specific characteristics that are required for specific groups of dishes that are imbedded within the traditions and culture of the community under study. The first squash cultivar mentioned below has a substantially larger fruit than the rest ('Xnuk kuum'). This and 'Xtop' have greater seed abundance than the other two varieties, 'Tzol' and 'Xmejen kuum'. The latter two are cultivated in lesser amounts (and smaller areas which usually consists of a few square meters within the homegarden or the community plots). As is the case of maize, the reasons mentioned were not consistent among informants. Some of them mentioned only one reason while others gave more than one; nevertheless all reasons are considered equally important. Reasons were less diversified in the case of squash. For example, specific forms of use were mentioned for each of the four cultivars, suggesting that each cultivar is grown because of specific culinary uses. Categories of reasons mentioned consist of the following (which are itemised and disaggregated by sex of respondent in Table 3.9): marketing, organoleptic characteristics (taste, smell), nutritional value, production (agromorphological and agroecological) characteristics, versatility of use, and specific food form (dishes).

Table 3.8 Encountered squash diversity

Cultivar (s)	Cultivar name (s)	Length of time present (yrs)*	Families	Production space		
				H	CP	AF
Cucurbita moschata (Duchesne ex Lam.) 'Xnuk kuum'	(Mayan) 'Nujuch kuum', big squash; (Sp.) 'pepita menuda', thin seed; (Sp.) 'calabaza de castilla'; (Sp.) 'calabaza torpe', clumsy squash.	20	F1	X		X
		9	F2	X	X	X
		77	F3			X
		20	F4	X		X
		8	F5	X		X
		8	F6	X		X
		26	F7		X	X
		20	F8	X		X
Cucurbita argyrosperma Huber 'Xtop'	(Mayan) 'Xca', 'Xcaita', a name given in young state); (Sp.) 'Campechana' (from Campeche); (Sp.) 'Bellota'	8	F1			X
		9	F2		X	
		8	F6	X	X	
C. pepo L. 'Tzol'	(Sp.) 'Mensejo'; (Sp.) 'Calabaza mediana', medium squash of 3 month.	9	F2		X	
		47	F3	X		
		8	F6	X		
Cucurbita moschata (Duchesne ex Lam.) 'Xmejen kuum'	(Mayan-Sp.) 'Plato kuum', referring to the flat shape in very mature state; (Sp.) 'Calabacita kuum', small squash: referring to its young state.	8	F6	X	X	
		26	F7	X	X	X
* Cucurbita argyrosperma Huber 'Chuk kuum'	(Sp.) 'Calabaza dura', hard squash.	1st year	F2		X	

H= Homegarden, CP= Community plot, AF= Agricultural field.
* No further analyzed as it was only found in one family who is trying it for the first time, no harvest yet at the time of field work.

Table 3.9 Reasons for cultivating a given squash cultivar

Cultivar	Marketing		Nutritional value	Organo-leptics	Production			Versatility of uses	Specific food forms		
	a.	b.	a.	a.	a.	b.	c.	a.	a.	b.	c.
'Xnuk kuum'	MF				M	M	M	F	MF	MF	
'Xtop'	MF				M		M			F	MF
'Tzol'				MF					MF		
'Xmejen kuum'		F	F							F	

The informants gave the following responses:

- *Marketing:* (a) ''To sell the seed''; (b) ''It is very nice to stuff *empanadas* (Sp. – a maize-dough snack), which I sell to the school teachers''.
- *Nutritional value:* (a) 'It is a very nutritious and healthy food….we also eat it alone, accompanied by beans''.
- *Organoleptic characteristics:* (a) ''It has the finest and softest flesh texture with delicious flavour…''.
- *Production characteristics:* (a) ''It helps the maize…fertilizes the soil''; (b) ''A few sown seeds give many fruits'' (yield); (c) ''Gives big amounts of seed''.
- *Versatility of uses:* (a) ''Can be used in many forms'' (both the fruit and the seed); ''Gives to us enough food to eat, to feed animals and seed to eat and sow again…"; ''For the seed that used in several regional dishes''.
- *Specific food forms (dishes):* (a) ''To cook *pipian*''; (b) ''To prepare the relish-sauce for *papadzules*'' (a regional dish); (c) ''It is the best one for '*caldos'* (Sp. – soups)''.

3.2.2.1 Cucurbita moschata (Duchesne ex Lam.) 'Xnuk kuum'

This was the most frequently encountered squash cultivar in the research sample. As is the case with maize, the term *Xnuk* (Mayan) refers to a long maturation cycle (about six months for this squash) and *'kuum* (Mayan) refers to the squash that has the specific type of seed

that is locally known as *'pepita menuda* (Sp.) meaning 'thin seed'. Although *Xnuk kuum* presents a wide range of intra-specific variability as it is the squash most cultivated by land extension (Interian Ku personal communication 2003), in this research only its variant, referred to as *Torpe* (Mayan - meaning ''clumsy'' due to its big size) was mentioned to as *"*a different 'Xnuk kuum*'* (Doña Elide, F6; Chona, F2). As there were not enough cases in this sample to support the diversity of names by intra-specific variability for 'Xnuk kuum', the epithet 'Xnuk kuum' is presented as a cultivar rather that as a cultivar-group. Reasons to cultivate it are presented in Table 3.9 above.

3.2.2.2 Cucurbita argyrosperma Huber 'Xtop'

The name *Xtop* (Mayan) refers to the seed of this squash cultivar and is locally called *pepita gruesa* (Sp. - thick seed) and *t'op* (Mayan) Other names given to this squash differ according to its maturation cycle, which is about about four months. In addition to 'Xtop', other names mentioned for this squash variety were *Xca* or *Xcaita* (Mayan), referring to this squash as an edible fruit and therefore related to its immature state (when mature the fruit becomes hollow and only the seed can be used). A presumed variant of *Xtop* is *Chuk* (Mayan - hard squash), a name referring to its hard shell which can be used as a container to carry drinking water. This variety was only found in one case where it was being tried for the first time and had not yet been harvested. Thus, this squash variety is not analysed further in this work as there was insufficient qualitative data about use and management within the production-consumption chain. On the other hand, this squash has been genetically identified as a variant of 'Xtop' whose seed can be used in the same way (Chavez-Servia personal communication, 2003). As in the case of 'Xnuk kuum', there were not enough cases in this sample to support the diversity of names by intra-especific variability, thus, the epithet 'Xtop' is presented as a cultivar rather than as a cultivar-group. Reasons to cultivate 'Xtop' are presented in Table 3.9 above.

3.2.2.3 C. pepo L. 'Tzol'

As far as known, the squash cultivar known as 'Tzol' has not been previously researched in this village. This squash was the least frequently cultivated (in reference to square meters of area cultivated) in the research sample. Reasons to cultivate this squash are summarized in Table 3.9 as well.

3.2.2.4 Cucurbita moschata (Duchesne ex Lam.) 'Xmejen kuum'

The squash known as 'Xmejen kuum' (the 'little sister' of 'Xnuk kuum' as it has the same kind of seed but in smaller quantities) was the least frequently encountered squash variety in terms of the number of families cultivating it (F2, F6). As in the case of maize, the term 'Xmejen' (Mayan) refers to a short maturation period (around three months). This squash was also identified by another name: *Xplato* (Mayan-Sp.- flat plate), referring to the shape it takes in its mature stage. Although 'Xmejen kuum' was scarcely cultivated by the research population, it was often found in markets where, in many cases, it was brought from outside the village. As is discussed later on, Yaxcaba is an highly commoditized and monetized village, which makes it a very attractive market for out-of-town entrepreneurs. No reasons to cultivate this variety were mentioned by men (see Table 3.9).

3.3 Encountered diversity: reasons for presence of a given cultivar at a given space

As mentioned in Chapter 2, the traditional agricultural system of the Yucatan, locally known as *'milpa ko'ol',* consists of several production spaces, where homegardens and agricultural fields are the two traditionally 'required' spaces for any farming family or household, with the possible presence of other spaces, for example, the community plots. Some cultivars are by custom considered to correspond to either one of the two most important 'traditional' production spaces. For example, in the case of maize, *Xmejenal* is considered to correspond to homegardens while Xnuk nal pertains to agricultural fields.

Figures 3.1 and 3.2 below give an overview of the estimated amounts cultivated by production space for maize and squash cultivars, respectively. In addition, the Appendix shows spatial drawings of 1) a reconnaissance of homegardens where both maize and squash are grown, and 2) the production spaces by family. The latter were elaborated in collaboration with men and women farmers using memory diagram methods and transect walks.

Figure 3.1 Amount and distribution of maize varieties in the research population

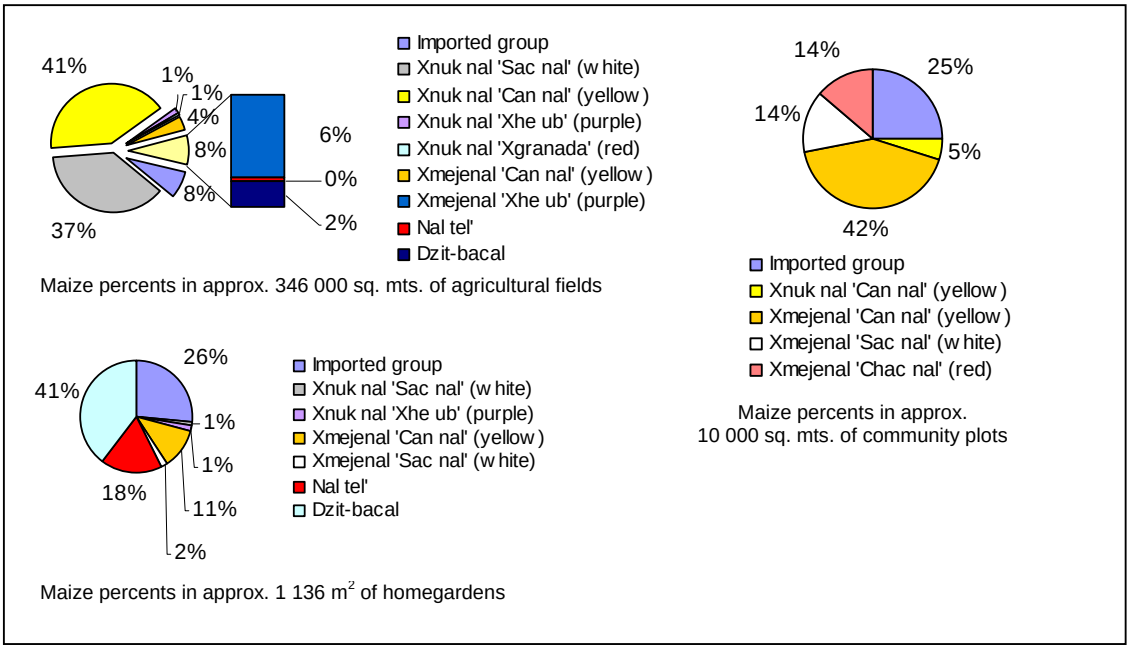
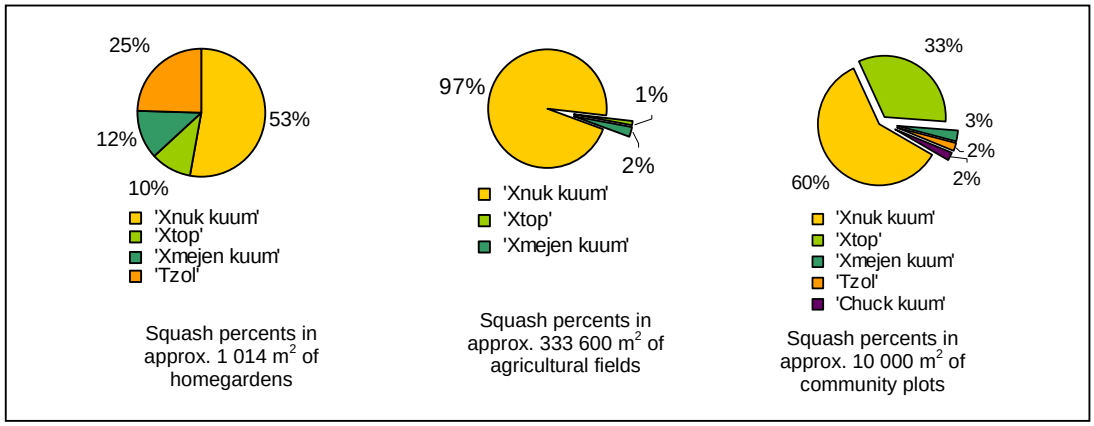


Figure 3.2 Amount and distribution of squash diversity in the research population



3.3.1 Maize

In the case of maize, as was frequently suggested in informal conversations with Yaxcabá villagers, this crop is considered to correspond mainly to agricultural fields, particularly due to the relatively large amount of area cultivated. That is, having maize means cultivating "at

least several *mecates".*[20] For example, when a local woman outside the research sample was asked what variety was the only maize plant in her homegarden, she replied:

> "I don't have maize".
> She was then asked:
> "You have one maize plant over there…. Do you know what kind [variety or race] it is?"
> "Ah! That one! I don't know…my father-in-law gave it to my daughter, but I don't have maize, my husband has it in the agricultural field…"

However, even when one of the production spaces has only one maize plant while the other may have hectares of it, the implication for the interaction between both traditional spaces for varietal conservation (implicit varietal selection) is still present. Such interactions may as also be a manifestation of both gender and age relations within households.

3.3.1.1 In homegardens

Although the traditional and sequential pattern of the homegarden includes a section where Xmejenal is grown (Vara 1995), in this research both the Imported group or improved varieties and Xmejenal were grown by four families with the only difference between them being that the estimated total area under cultivation of the Imported group cultivation was slightly higher among some families. Moreover, three out of the four families were trying the Imported group of cultivars for the first time and had sown this maize in the homegarden while also sowing it in the agricultural field (F1) or in the community plot (F2) or both in the field and the community plot (F7). As to Xnuk nal 'Sac nal', this cultivar was only found in one homegarden. Although the research sample does not reflect an outstanding presence of Xnuk nal in homegardens, these were often found during the transect reconnaissance in the community. In some cases, this was the first time (perhaps for some time) that people were sewing this variety in this production space, as indicated in informal chats with villagers outside of the research sample. 'Xhe ub' was also grown only by one family in the homegarden. Finally, 'Nal tel' (F3, F5) and Dzit bacal 'blanco colmillo' (white); 'amarillo colmillo' (yellow) (F8) were the least frequently found maize cultivars in homegardens. Table 3.10 presents the reasons for the presence of a given maize cultivar in homegardens:

Table 3.10 Reasons to grow Zea Mays L. in homegardens

Cultivar	Access ibility	Breeding tech.	Cultural values		Educa-tional	Experim entation	Sale	Plant care				Space avail.	Plant own.
	a.	a.	a.	b.	a.	a.	a.	a.	b.	c.	d.	a.	a.
Imported group	M	M			M	MF		M				MF	
Xmejenal 'Can nal'	F		F									F	F
Xmejenal 'Sac nal'						M							
Xnuk nal 'Sac nal'						M						M	
Xnuk nal 'Xhe ub'					M		MF		M	F			
'Nal tel'			F	F							MF		

The informants gave the following responses:

- *Accessibility:* (a) ''It is good to have maize nearby…''; ''At harvest time, it is easier to have it here than going to the fields to pick some''.
- *Breeding technology:* (a) ''I sow the Hybrid here because I don't want to mix it with the Xnuk nal I have in the field, nor with the Xmejenales I have in the community plot…''.
- *Cultural values:* (a) ''It is part of the homegarden. Some people do not grow Xmejenal any more in the homegardens but it is the tradition''; (b) ''It is a very valued seed for us, the '*Mayeros* [(Sp.) Mayan people]''.
- *Educational purposes:* (a) ''for the kids to learn and practice sowing maize''.

[20] *Mecate* (Mayan) is an ancient measure used to subdivide plots. It currently consists of 20 x 20 m or 400 m^2. Previous to colonization it was believed to consist of 21.80 m^2 (Anonymous 1997).

- *Experimentation:* (a) ''…she wanted to have some in the homegarden because it is the first year we have it and we can see how good it is''; ''Just to try the new seed''; ''He got the seed and is trying it here''.
- *Marketing:* (a) ''People stop by and buy it''.
- *Plant care:* (a) ''….here She takes care of it because I work all day at the Municipality…''.; (b) ''…it can be better cared for in case of an intense drought…"; (c) ''To take care of the plants against bird attack…"; (d) ''The seed is very scarce and needs to be cared for very well''; ''The soil and care that can be given in the homegarden are good to keep the maize'.
- *Space available:* (a) ''There is some space in the homegarden…".
- *Plant ownership:* (a) ''I like to grow my own plants in the homegarden''.

It may be the case that, this year, Yaxcabanians were more concerned about 'having something' in homegardens because of the previous two difficult agricultural cycles: 2001 was a year of a strong drought (Tuxill 2002) and, in 2002, the community was hit by a category 4 hurricane and most of the harvest was lost.

3.3.1.2 In agricultural fields

As Figure 3.1 above shows, amounts cultivated of maize are grown in quite distinct extensions. That is, while Xnuk nal yellow and white together occupy about 78% of the area cultivated in agricultural fields by six and five families respectively out of eight - the nearest maize cultivars in terms of extension were Xmejenal and the improved populations or imported group, with 10% and 8% respectively of the area in agricultural fields. This corroborates the fact that Xnuk nal is the principle maize variety (actually a race) for the population under study. However, it does not mean that the varieties cultivated in smaller areas are less valued for the population under study. Table 3.11 summarizes the reasons given by men and women for cultivating a given maize cultivar in agricultural field(s).

Table 3.11 Reasons for cultivating Zea Mays L. in agricultural fields

Cultivar	Breeding technology	Cultural values	Experim entation	Harvest amount	Large area for cultivation	Male labour availability	Marketing
Imported group			M		M		
Xnuk nal 'Sac nal' (white)	M	M		MF	MF	MF	
Xnuk nal 'Can nal' (yellow)		M		MF	MF	MF	M
Xnuk nal 'Xhe ub' (purple)				MF	M		MF
Xnuk nal 'Xgranada' (red)				MF	M		
Xmejenal 'Can nal' (yellow)				MF	M		
Xmejenal ''Xhe ub' (purple)				MF	M		
'Nal tel'			M				
Dzit bacal 'Blanco colmillo'		M		MF	M		
Dzit bacal 'Amarillo colmillo'		M		MF	M		

The informants gave the following responses:

- *Breeding technology:* 'grown here to avoid mix it with other maizes''.
- *Cultural values:* ''It is part of the milpa….a very valued seed for us, the 'Mayeros [(Sp.) Mayan people]'' .
- *Experimentation:* ''…to try the seed ''.
- *Amount:* ''to obtain enough maize for the rest of the year''.
- *Large area for cultivation:* ''large extensions of land can be cultivated…".
- *Male labour availability:* ''it is a men's task''.
- *Marketing:* ''To have enough for us and to sell'.

3.3.1.3 In community plots

The production space here identified as 'community plots', which consist of land allocated to certain families for future housing, is currently used for cultivation purposes. Cropping patterns here seem to differ from the homegardens where women cultivate species that 'do not requite a lot of work' such as onions, coriander, chili peppers and fruit trees (Morales and Quinones 1999). Rather, community plots are organized as a kind of 'mini-agricultural field'. That is, maize is intercropped with squash and beans (Phaseolus vulgaris, p. lunatus, v. unguiculata) and other small areas are cultivated with other 'agricultural field cultigens' such as yams (Dioscorea spp.) and cassava (Manihot esculenta Crantz). Differences in patterns and gender relations are evident both vis-à-vis agricultural fields and vis-à-vis homegardens. The following reasons were mentioned for cultivating a given cultivar in community plots, which are summarized in Table 3.12.

Table 3.12 Reasons to grow Zea Mays L. in community plots

Cultivar	Accessibility	Breeding techniques	Experimentation	Space available
Imported group			MF	M
Xnuk nal 'Can nal' (yellow)	MF			MF
Xmejenal 'Sac nal' (white)	F	M		
Xmejenal 'Can nal' (yellow)	F	M		M
Xmejenal 'Chac nal' (red)	F			M

The informants gave the following responses:

- *Accessibility:* ''It is good to have maize nearby… ''; ''At harvest time, it is easier to have it here than going to the fields to pick some''.
- *Breeding technology:* ''I sow this maize here because I don't want to mix it with the maize I have in the field or in the homegarden, so it keeps pure…''.
- *Experimentation:* ''To try the new seed''; ''He got the seed and is trying it there''.
- *Space available:* ''There is enough space in the community plot [(Sp.) *'terreno'*]…" .

3.3.2 Squash

The case of squash is somewhat different from that of maize as each squash variety seems to correspond to either agricultural fields or homegardens, according to the plants' need for care (plant management).

3.3.2.1 In homegardens

Regarding squash varieties found in homegardens, the cultivation pattern is somewhat different than that which occurs in agricultural fields. That is, in homegardens, squash is usually grown separately from maize (F1, F2, F4, F5, F6, F7) rather than intercropped, as occurs in agricultural fields (see production space drawings in the appendix). Only in two cases were squash plants found growing between maize cultivars: in the first case, it was 'Tzol' squash (F3) and in the second case 'Xnuk kuum' (F8). Moreover, the last was the only case where a man sowed squash in the homegarden, suggesting that different cultivation patterns may be practiced by men and women. 'Xnuk kuum' was mainly sown by women (F1, F2; F8 - wife and husband) or germinated spontaneously from residuals of consumed squash. Of all four of the varieties here analysed, this Cucurbit is the one that occupied more land area in homegardens (indeed it is the most abundant squash in the area). As to the other squash found in homegardens, 'Xtop' was only present in one of the two homegardens held by F6,[21] one of the richest homegardens in the village so that not even Doña Elide knows how many species she has there. Thus, 'Xtop' is not the only squash grown in that

[21]Doña Elide has two homegardens, one that belongs to the house where she resides and the other just in front of her house where she and her husband have built a house for one of their sons when he is married.

homegarden. She is also growing 'Tzol' and 'Xmejen kuum'. Indeed, squash cultivars have a very special place in this homegarden, not only in terms of extension and location but also in Elide's interests, such as the food that she prepares to sell. This and other reasons for cultivating squash varieties in homegardens are summarised in Table 3.13 below.

Table 3.13 Reasons for cultivating squash in homegardens

Cultivar	Food availability	Marketing	Plant care	Space available
'Xnuk kuum'	MF	F		M
'Xtop'		MF		
'Tzol'	F		F	
'Xmejen kuum'	F	F	F	

The informants gave the following responses:

- *Food availability*: "…When one wakes up in the morning, one doesn't know what is going to eat… one needs to look for the food of the day for the family… sometimes I just walk over the homegarden and found out what is available''.
- *Marketing:* "…This is a way to make some pennies (money)…either with the staff cook and sell or people just stops by to buy…''.
- *Plant care:* ''Plants are too delicate to manage, so they can be better cared in homegardens''.
- *Space available:* ''There was some space available in the solar so is good to grow some squash there''.

3.3.2.2 In agricultural fields

In the case of the three squash varieties grown in agricultural fields in the research sample, as with maize there are substantial differences in area cultivated per cultivar. 'Xnuk kuum', the 'default' squash in agricultural fields, is grown by all eight families in the research sample and occupies an estimated 97% of the squash area cultivated, while 'Xtop' occupies about one per cent, and 'Xmejen kuum' was grown only 'by accident' by F7 in this space, in an estimated two per cent. Although 'Xtop' is a constantly cultivated squash in the region due to the high gastronomic and market value of its exotic green-coloured seeds, in the target community it was found to be grown in agricultural fields only by F1 where it was cultivated in a relatively small area. Reasons given for cultivating squash in agricultural fields are below summarised (Table 3.14).

Table 3.14 Reasons for growing squash in agricultural fields

Cultivar	Cultural and family values	Grown by accident	Space available	Harvest amount	Marketing
'Xnuk kuum'	M		MF	MF	MF
'Xtop'	M		MF	MF	MF
'Xmejen kuum'		MF			

The informants gave the following responses:

- *Cultural and family values:* 'it is the squash of the agricultural fields [(Sp.) milpa]'; ''Seed very valued for our family and our community''.
- *Grown by accident:* the man confused the seed with 'Xnuk kuum' which was previously selected by the woman.
- *Space available:* ''There was some space available in the solar so is good to grow some squash there''.
- *Amount*: ''To have enough squash for some time''.
- *Marketing:* "…To have some to sell….people knows we have it nearby…''.

3.3.2.3 In community plots

In two out of three community plots within the research sample, more squash varieties were found than in agricultural fields and, in one of the community plots, one more variety was found than in the family's homegarden. For example, F2 grows four squash varieties in the community plot and only one in the homegarden. On the other hand, men seem to have a greater sense of 'belonging' in community plots (i.e., men sow some of the squash there) compared to the homegarden (where they are not likely to sow squash), while accepting it as 'normal' that women enter the community plot freely and alone, although they do not go to the agricultural fields alone. The following reasons were mentioned to grow a given squash in community plots.

Table 3.15 Reasons to grow Cucurbit in community plots

Cultivar	Food availability	Harvest amount	Marketing	Soil quality	Space available
'Xnuk kuum'	MF	MF		M	M
'Xtop'		MF	MF	M	M
'Tzol'				MF	
'Xmejen kuum'	MF	MF	F		

The informants gave the following responses:

- *Food availability:* "…When one needs some squashes and there is none in the homegardens is easier to go the plot than going to buy or to wait to see if the man brought something from the field''.
- *Amount:* ''To have enough squash for some time''.
- *Marketing:* "…To have some to sell….people knows we have it nearby…''.
- *Soil quality:* ''because the soil is very good [(Mayan) 'Kankab'] there is no need to apply fertilizer and squash plants do not die''.
- *Space available:* ''There was some space available in the solar so is good to grow some squash there''.

3.4 Gendered crops and gender production spaces

Although a given cultivar might be associated with either men's or women's production space, this does not mean that the decision to cultivate it pertains solely to either the man or the woman who manage the space (see Chapter 5 for further details). Therefore, the concept of 'gendered crops' when applied to the population under study could be more associated with the gendered division of labour and related gendered knowledge about plant management, which may indeed differ by production space. The concept of 'gendered crops' refers to the cultural association between particular crop species or varieties and sex of the producer. In an example where such a distinction is embedded within folk taxonomy and the gender division of labour, Sillitoe (2003) showed that, among one tribal group in New Papua Guinea, crops might be: male only, mainly male, both sexes, mainly female, and female only. Other research shows that the degree to which a given crop is associated culturally with either men or women may vary according to the division of labour in the production-consumption chain. For instance, in the case that was mentioned in Chapter 1 about sweet potato in the Philippines (Amalin et. al 1991), this crop is considered as 'woman's crop' during the production stage, but as a ''man's crop' during marketing. Such distinctions are likely to reinforce power relations between men and women that may underpin the material reproduction a given social group: Sillitoe hypothesized that women's crops are those required for subsistence, whereas men's crops are those required for ritualistic exchange, so that it is important that men are not tempted to produce a surplus of subsistence crops, which might break down the exchange system (Sillitoe 2003). Gendered crops are a frequent phenomena across much of Africa. For example, beans (Phaseolus vulgaris) in Rwanda (Sperling and Berkowitz 1994) and in Malawi (Ferguson and Mkandawire 1993) are considered as women's crop and women are responsible for most of the tasks within the production-consumption chain. The same is the case with cassava (Manihot esculenta)

across most of sub-Saharan Africa and in the Amazon in South America (Wilson 1997; Spijkers 1981 citing Aspelin 1975).

In the Yucatec community under question, it has been shown that productive relations within the family are determined by age and sex (Perez Ruiz 1983), where men's main subsistence activities are related to agricultural fields whereas women's main tasks are related to the so-called domestic sphere where homegardens represent a major physical component. It may be the case that gender relations are more clearly manifest in these traditional production spaces than in 'new' spaces (community plots), or than in relation to maize and squash cultivars as 'men's' or 'women's crops. From the results presented in this chapter alone, it could be posited that maize could be considered as predominately 'male' since it is mainly grown in the agricultural fields whereas squash could be considered as pertaining to 'both sexes' but where two varieties seem to be predominately female. However, before reaching conclusions regarding the gendered nature of maize and squash in this community, factors discussed in other chapters will be considered together with the data presented below.

3.4.1 Maize as a 'mainly male' crop?

Maize is the main food staple for the population under study. For instance, *tortillas* are served with every meal, and are considered as the main food item (Teran et al. 1998). Maize needs to be cultivated in large amounts in agricultural fields as a means to provide enough food for the family for the upcoming months and hopefully the rest of the agricultural year; it's cultivation by men in agricultural fields conforms to a 'man-the-bread-winner' archetype it is considered 'dangerous' and not socially accepted for women to venture alone to the fields.[22] In addition, women are only allocated agricultural land in special situations, such as in the case of widowhood (Yaxcaba, *ejido* commissioner, personal communication 2003). Maize grown in other production spaces (homegardens and community plots) was, in most of the cases, sown by men. In spite of the fact that women are in charge of most of the post-harvest tasks for maize within the production-consumption chain (see Chapter 4), the above suggests that women's physical access to areas where the largest amounts of maize are produced is limited although not forbidden, and this access is principally related to labour scarcity. As will be seen in Chapter 4, women are also in charge of most steps within the production-consumption chain for this crop. Therefore, even if maize could be considered to be mainly a male crop since it is produced by men, men's decision about which cultivars to grow might be influenced by women considering their knowledge and roles in post-harvest management and final consumption.

On the other hand, although maize in could be considered as a male crop since it is mainly produced in agricultural fields, some maize cultivars might traditionally be associated with homegardens, which might also suggesting the influence that men might have over an otherwise female production space. Tables 3.16, 3.17 and 3.18 show the ranking of maize cultivars by percentage of cultivated area under this crop in a given production space and who has sown such cultivars by family.

[22]For example, in the only case where a woman has sown maize in the agricultural fields (F3), she rides a tricycle with a wagon and takes her very sick husband to the field where she does most of the tasks.

Table 3.16 Ranking of maize cultivars by percentage of production area under this crop in homegardens

	Estimated % of cultivated area	***Sown by:***
Dzit-bacal	39 %	[F8 M]
Imported group	26 %	[F1 F] [F2, 7, 8 M]
'Nal tel'	18 %	[F3 F] [F5 M]
Xmejenal	14 %	[F1,3,6 F] [F4 M]
Xnuk nal	3 %	[F4, 8 M]
	100 %	

Table 3.17 Ranking of maize cultivars by percentage of production area under this crop in agricultural fields

	Estimated % of cultivated area	***Sown by***
Xnuk nal	80 %	[F3MF] [F1,2,4,5,6,7,8 M]
Xmejenal	10 %	[F1, 6 M]
Imported group	8 %	[F1, 7 M]
Dzit-bacal	2 %	[F8 M]
'Nal tel'	< 0.5 %	[F1 M]
	100 %	

Table 3.18 Ranking of maize cultivars by percentage of production area under this crop in community plots

	Estimated % of cultivated area	***Sown by:***
Xmejenal	70 %	[F2 MF] [F6 M]
Imported group	25 %	[F7 M]
Xnuk nal	5 %	[F7 M]
	100 %	

3.4.2 Squash as a 'both sexes' crop (with 'mainly female' varieties)?

Squash is a complementary item within the local diet, which is based mainly on maize. However, squash still plays a primary role within the traditional agricultural system and in local cuisine and nutritionally. In contrast to the case of maize - where in spite of the fact that it is grown mainly by men, women do influence varietal selection - for squash crops, two cultivars can be considered to be nearly totally within women's domain, or as 'mainly female' crops, since women predominate from the production stage through to final forms of consumption (see Chapter 4 for further details). These are C. pepo L. 'Tzol' and Cucurbita moschata (Duchesne ex Lam.) 'Xmejen kuum'.[23]

As to the other squash cultivars, Cucurbita moschata (Duchesne ex Lam.) 'Xnuk kuum' and Cucurbita argyrosperma Huber 'Xtop', the former was the only cultivar that a man had sown in the homegarden (F8). In most of the cases, it was mainly sown by women or germinated by itself in the soil from residues of consumed squash. Of all four of the varieties here analyzed, this is the one that occupied more land area in all three types of production space. The case of 'Xtop' is similar to that of 'Xnuk kuum'. Although in the research sample 'Xtop' was not found in agricultural fields in notable amounts, it is well known in the area that this squash is likely to be grown in fields. This because of the large areas that can be cultivated there to obtain a sizeable harvest, which is mainly used to supply market demands: 'Xtop' seed is an indispensable item for some traditional dishes in the Yucatan Peninsula. suggesting the influence of local cuisine in varietal selection.

Regarding the squash cultivars grown in community plots, the new' space where gender boundaries seem to be more fluid than in the 'traditional spaces', negotiation and agreements regarding amounts and distribution - not only of squash but also of maize varieties - seem to potentially be more explicit and egalitarian. For example, Chona from F2 has sown both of

[23]'Xmejen kuum' was present in the agricultural fields – men's production space - only because of the confusion of the man who had sewn the seed (he thought it was 'Xnuk kuum' seed). 'Xmejen kuum' and 'Tzol' were mainly sown by women with the only exception being in F2 where both men and women grow them in their community plot.

her very appreciated squash varieties and Doña Elide and Don Florencio from F7 - who have two community plots - have established two different cropping patterns in each of the two community plots: one resembling her homegarden and the other resembling an agricultural field, with 'Xnuk kuum' sewn over the entire area (see figure production spaces F6 in the appendix), reflecting the different cropping patterns followed by men and women. Tables 3.19, 3.20 and 3.21 give the rankings in terms of area cultivated for squash cultivars in each type of production space as well as who was responsible for the sowing each cultivar.

Table 3.19 Ranking of squash cultivars by percentage of production area under this crop in homegardens

	Estimated % of cultivated area	***Sown by***
'Xnuk kuum'	53 %	[F1,2,5 self-germinated] [F4 F] [F8 MF]
'Tzol'	25 %	[F3,6. F]
'Xmejen kuum'	12 %	[F6,7. F]
'Xtop'	10%	[F6 F]
	100 %	

Table 3.20 Ranking of squash cultivars by percentage of production area under this crop in agricultural fields

	Estimated % of cultivated area	***Sown by***
'Xnuk kuum'	97 %	[F3 MF] [F1,2,4,5,6,7,8. M]
'Xmejen kuum'	2 %	[F7 M accidentally]
'Xtop'	1 %	[F2 M]
	100 %	

Table 3.21 Ranking of squash cultivars by percentage of production area under this crop in community plots

	Estimated % of cultivated area	***Sown by***
'Xnuk kuum'	61 %	[F2 MF] [F6,7. M]
'Xmejen kuum'	34 %	[F6 M] [F7 M accidentally]
'Xtop'	3 %	[F2 MF] [F6 M]
'Tzol'	2 %	[F2 MF]
	100 %	

3.6 Conclusions

Maize landraces are by far the most widely and extensively cultivated cultivars in comparison with local crossed populations and improved varieties. Of these, the most cultivated variety is Xnuk nal, referred in the breeding literature as the Pre-Columbian Mexican race (Tuxpeño) and considered by local curators to be "our maize". The predominance of this maize cultivar across the study area does not mean, however, that other landraces are of less importance or value for the population, since reasons given for cultivating the diverse varieties discussed herein have demonstrated. Although men acknowledge women's reasons for cultivating a given cultivar and vice versa, these reasons may differ by sex. Men may tend to hold a given maize cultivar because of agromorphological and agroecological performance without forgetting the cultural and family values of the seed they have been maintaining for generations, and that is usually transferred through patriarchal lines. Women mentioned maintaining a given cultivar because of processing and food preparation characteristics and, with less frequency, because of the potential income they can generate with some of the cultivars (both maize and squash) that are produced within the female domains.

Reasons for growing a given cultivar in a given space seem to be related to some extent to the gendered affiliation of crops. Maize, the main food staple for rural Yucatecan families, must be grown in large amounts and, therefore, the agricultural fields are the most

appropriate space. When grown in homegardens, men seem to use this space as an experimental station to try new maize varieties, or as a genetic bank where varieties can be protected from risks encountered in the fields (i.e. predator attack). However, for women the most outstanding advantage of growing maize in homegardens seems to be the possibility to have some food available near the home. The community plots represent an advantage for both men and women: for men because of the large extension and possibility to grow considerable amounts of maize while perhaps relying on complementary female labour force; and for women because they can freely access considerable amounts of maize, something that is not possible for them with respect to agricultural fields.

For squash, the delicate management required in cultivation means that homegardens are the most suitable space to grow it. This is indeed more applicable to some cultivars than to others. For instance, 'Tzol' could be considered as a 'mainly female' squash variety as it has been found only in homegardens and community plots, and it is planted, tended and harvested mainly by women. 'Xmejen kuum' could be also considered as a 'mainly female' variety as there seems to be a preference for growing it in homegardens for the same reasons, however it can also be found in agricultural fields. Regarding the other two squash varieties, although the research sample may not totally reflect it, it is well known that they are generally grown in agricultural fields and therefore that women's labour is not as predominant as in the case of the formerly-mentioned squash.

Findings related to the interaction among production spaces suggest that, as homegarden are considered to be principally a female domain while agricultural fields are a masculine domain, gendered codes of behaviour are stronger in these two 'traditional 'spaces. In the case of a 'new' production space, as are the emerging community plots, gendered boundaries are more fluid and unbound by tradition, as both men and women explicitly share and consider the preferences of both regarding what cultivars to grow and in what amounts. This invites further reflection about transformations and adaptations that occur when gendered norms become less restrictive. Subsequent chapters further explore such dynamics as means to provide deeper insights into the ways in which men and women influence each other for varietal maintenance and selection by: 1) analysing participation and interests of both men and women in the selection of varieties according to specific qualities within different steps within the production-consumption chain (Chapter 4) and 2) exploring how men and women exercise decision making about the cultivars selected for the upcoming cycle (Chapter 5).

4 GENDER, VARIETAL SELECTION AND THE PRODUCTION-CONSUMPTION CHAIN

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Chapter 4: Gender, varietal selection and the production-consumption chain

> The main sustenance is maize, of which there are diverse dishes and beverages, and it serves them as both food and drink. The indian women place the maize in lime and water the night before, and in the morning it is soft and half cooked, and you grind it in rocks. The half ground dough is given to the workers, haulers and travellers in the form of great balls and cargoes and it lasts months, becoming only a little sour; and they take a ball and dissolve it in a cup made from the shell of a fruit grown by a tree and they drink this substance and eat the rest and it is flavorful and gives grand sustenance. From the well-ground dough they extract a milk and they boil it over fire and make something like fritters in the morning and they drink it hot; and to what remains from the morning they add water to drink it during the day as they are not accustomed to drink water alone. They also toast the maize, grind it and dissolve it in water, which is a very fresh beverage to which they add a few indian chillies and cocoa. They make bread in many ways, all good and healthful; and the indian women make it twice… (Friar Diego de Landa 1566 in Baeza *et al.* 2003:18-19)

4.0 Introduction

Farming communities in the developing world depend on biodiversity for their well-being, particularly in production environments that are agroecologically heterogeneous and where commercial seed markets may not develop due to the scarcity of profit opportunities, remoteness, or where economic opportunities are limited aside from labour migration (Smale 2002). In these places, specific agroecological conditions such as soil heterogeneity, climate and rainfall levels are have been considered as the key factors determining the spatial and temporal variation of cultivated diversity. In Yucatan, field crop agriculture is based on the traditional swidden system. It is relatively the same system followed for at least the last 3000 years, except for the use of herbicides and fertilizers, and is based on a simple procedure that begins with cutting brush and foliage where the non-usable parts are then burned, followed by seed sowing and, after a few years, a fallow period that traditionally lasted up to 10 years (Morley 1947), although recently the fallow periods have reduced very substantially. No alternative to slash-and-burn has been found to be viable for this region due to the shallowness and stoniness of the soil, and consequently farmers are unwillingness to use draft animals for land preparation (Ibid).

Two agroecological factors are of great importance for farmers in the area under study in relation to the choice of cultivars. These are soil type and the date of onset of the rainy season. They will choose where to grow a given cultivar according to soil heterogeneity in the fields. As suggested by the data collected by Graefe (2001) and Chávez-Servia *et al.* (forthcoming), rendzine soils are like to result in higher yields. These soils are therefore more valued by farmers; however, when soils in their field are predominately stony, they grow those varieties considered as 'more resistant' (i.e. Xnuk nal, 'Nal Xoy'). The beginning of the rainy season is of importance since it determines the moment of sowing, which begins immediately away after the first rains of the season (Morley 1947). Therefore, rain delay or rain scarcity may mean a 'difficult' year as farmers may need to sow the seed more than once with the risk of a poor harvest. Indeed, at the beginning of field work in the research here presented, some farmers were sowing for the third time due to rainfall delay. However, farmers are not only influenced by 'empirical' agroecological considerations: ethnocultural values are entailed in obtaining a good harvest as well. Yucatec Mayas carry out rituals at the time that they clear and burn a field, when rain is needed, at the time of harvest and also when the harvest fails.

Just as farmers' agroecological considerations cannot be separated from technology,

environment, biochemistry, genetics, culture and ethnicity, neither can post-harvest management. All of these influences and determine specific forms and techniques for storage and processing in a given environmental and cultural context. Storage and processing are two intermediate steps in the production-consumption chain (within these steps are preservation and food preparation) which are of much importance since specific varietal requirements are determined here. That is, a given cultivar might be preferred because of its specific storage and processing characteristics. Moreover, varietal selection criteria are partly determined by final forms of use, that is, a specific final form of use may require specific management and techniques for storage and processing, and it may be also the case that storage and processing techniques (e.g. fermentation) give rise to specific forms of use. These steps require a certain degree of technical environmental knowledge and skills, as well as in-depth knowledge of cultivar characteristics.

In the case of the Yucatan, the high humidity and temperature levels are reported to be key factors in post-harvest management. For instance, the best maize ears are first selected on the plant rather than in granaries, whereas the latter is the preferred selection site over most other temperate regions in México (Chávez-Servia *et al.* forthcoming). When placed in granaries, ears are vertically stored with husks on rather than horizontally and with or without husks, as is frequently seen in other areas of México and the world. Some processing and food preparation steps are preferentially done at night and many of the daily forms of consumption (i.e. maize beverages, thick maize cake and pink *tortillas*) have a sour flavour that is the product of fermentation. However, the influences that the above may have on cultivar selection have barely been explored.

The domestic sphere tends to be ignored when factors influencing varietal selection are researched since there has been a clear bias toward agromorphological and agroecological characteristics and influences. This is especially a point of concern when targeting traditional agricultural systems since smallholder traditional agricultural systems are oriented mainly toward subsistence where most of the product obtained is destined to the domestic sphere (for own consumption). Under such a scenario, the kitchen is "quite possibly the most under-valued site of plant biodiversity conservation" (Howard 2003:13). This is supported by findings in many world regions that have demonstrated that it is within the domestic sphere where continuous maintenance of genetic resources is promoted (i.e. Howard 2003 citing Johannessen 1982; Ibid citing Shellie-Dessert and Hosfield 1990; Ibid citing Zimmerer 1991; Ibid citing Defour et al. 1996; Wilson 1997). As has already been evaluated in the area under study, agroecological factors have a strong influence in varietal selection. However, the domestic sphere may exert the most influence on crop diversity conservation as most of the products are destined for own consumption.

This chapter describes the production-consumption chains in the area for the crops under study and how these affect varietal selection. As Howard (2003) argues, plant varietal selection for food involves not only consideration of desired culinary qualities and transmission of ethnobotanical and culinary knowledge and skills, but also involves aspects such as local knowledge, labour and fuel availability, and plant's biochemical composition. Moreover, the latter influence processing characteristics, storability and preservation methods, which are related to the available technology and environmental factors (i. e. temperature, humidity, incidence of pests and diseases) and often also entail indivisible tasks. That is, "the same person may select, separate, process and store plant products simultaneously for the next crop, for home consumption and for sale" (Ibid.).

First, forms of use by part of the plant were listed for both maize and squash cultivars where informants were men and women heads of household and individuals who are recognised in the village for their knowledge about the diversity of the crops under study (see annex). Although medicinal uses were mentioned, the most common forms of use consisted of food items for own-consumption and food for animals. The available literature (Terán *et al.* 1998;

Cazares and Duch forthcoming) and field observations were used to produce detailed diagrams of the production-consumption chain for both maize and squash cultivars.

Second, men and women heads of household were asked about the post-harvest management steps within the production-consumption chain in which family members are involved, with the purpose of identifying both the steps and the gender division of labour within these steps for the selected crops. Such steps consist of: seed selection, storage, processing, food preparation and final consumption. For varietal characteristics in crop production, previous findings from plant breeding research in the area are used (Chávez-Servia *et al.* forthcoming; Canul *et al.* 2002; Graefe 2001). Responses regarding maize post-harvest management suggest that men predominate in storage whereas women predominate in processing and food preparation and in determining final forms of consumption. Both men and women have relatively equal involvement in seed selection and marketing (although the latter has not been fully assessed in the work presented here since marketing was not prevalent). In the case of squash, storage, processing and food preparation seem to be mainly under women's control, but a difference appears with regard to seed selection and marketing. Both men and women are likely to select seed for the cultivars usually grown in the fields while only women do select seed of squash only found in homegardens. Regarding marketing, either men or women predominance depends on the part of the plant involved: if it is the fruit, women predominate but if it is seed, men do so.

Third, after identification of the post-harvest gender division of labour per crop in the production-consumption chain, men and women respondents each ranked desired cultivars characteristics in relation to a given step within the chain. Both men and women within the research sample who cultivated the greatest number of cultivars of either of the two crops were first asked which cultivar they considered to be the best for a given step, which was regular and which was less suitable and why. A limitation of such an exercise was that not all of the informants have been in contact with all of the cultivars covered in this study. Rankings were made according to the opinions of a few informants (four men and six women for maize; three men and four women for squash). In the cases were these informants were not able to provide a ranking for a given cultivar since they did not cultivate it, pair-wise comparisons were made with those who do cultivate such cultivars. Data regarding agroecological varietal selection criteria are taken from previous research in the village under study (Chávez-Servia *et al.* forthcoming; Graefe 2001). Ranking of maize cultivars revealed a greater number of selection criteria in storage steps for men than for women, where men have a tendency to assign a higher ranking to landraces and local crosses than to improved populations. Women have a larger number of ranking criteria for maize cultivar processing steps, where daily forms of consumption are limited to a few forms (*tortilla* and the maize beverage or (Mayan) *keyem/pozol*). It appeared that women are more concerned about qualities that are related to time efficiency and quality for these principal daily uses, rather than criteria that are related to the use of maize as a main ingredient of more than 60 regional dishes (Cazares and Duch forthcoming). Women also had a larger number of criteria than men in relation to squash, where each cultivar seems to have some specific characteristics that cannot be substituted by another squash cultivar, and therefore final forms of consumption account for a greater number of criteria in comparison with maize.

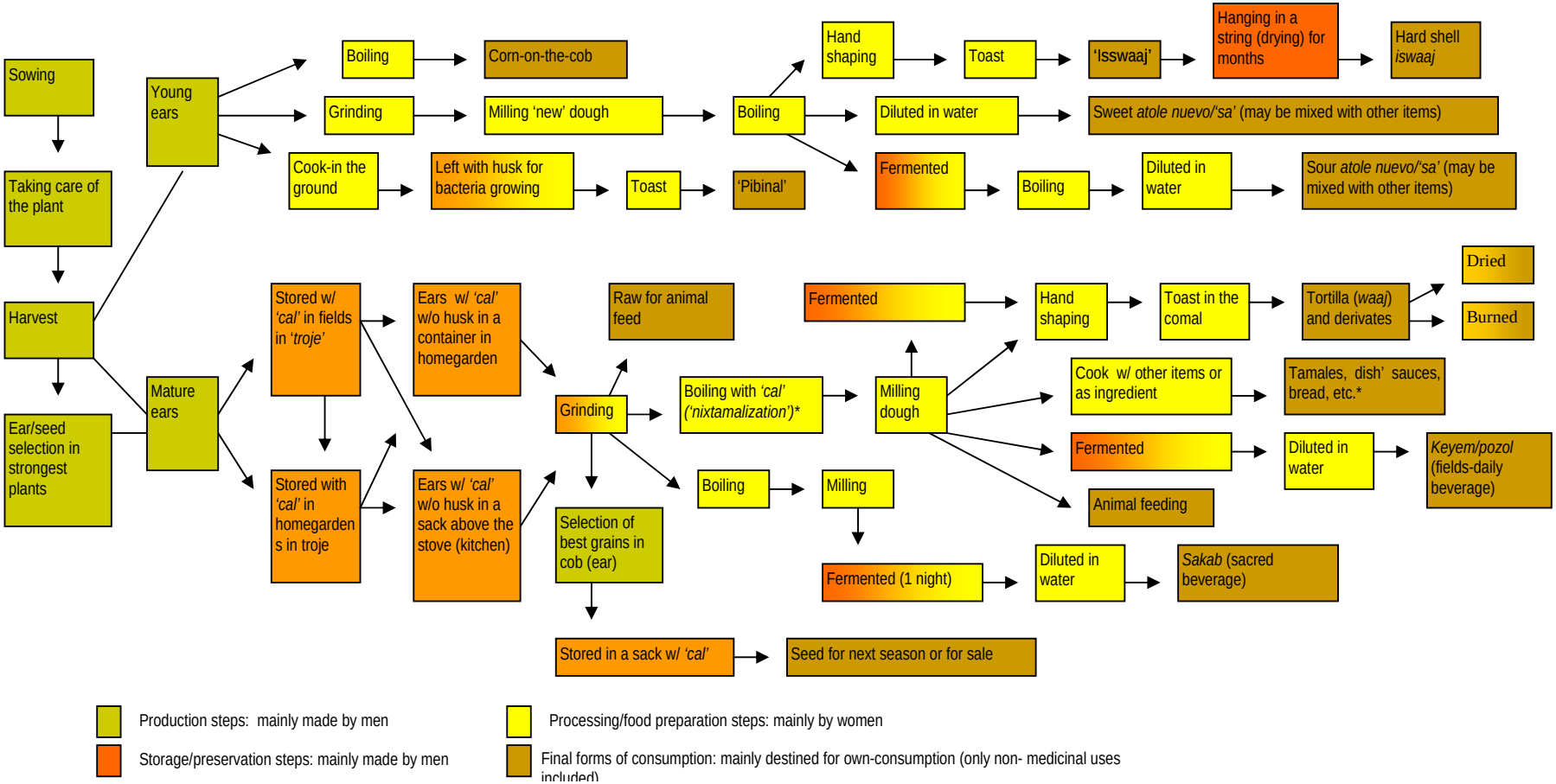
Conclusions from this chapter suggest that both men and women prefer landraces over local crosses and improved populations, although men may focus more on production and storage characteristics while women are more concerned with processing characteristics, food preparation and final forms of consumption. A given cultivar is therefore selected according to the requirements of both men and women whose respective criteria are related to specific steps in the production-consumption chain, where final consumption occurs mainly in the domestic sphere. Moreover, such criteria represent the basis for negotiations between men and women about what cultivars to grow in a given space, which are indeed informed by the gender division of labour and underlying gender norms. This is further explored in Chapter 5.

4.1 The maize production-consumption chain and cultivar ranking

Figure 4.1 provides an overview of the production-consumption chain for maize according to the main forms of use that were identified for the population under study. Most of the uses consist of food forms that have been inherited from the ancient Maya as described by the Friar Diego de Landa in the famous book, *An account on the things of the Yucatan*, with observations dating back to 1566. Such forms of use can still be considered as unique to the area. The production-consumption chain consists of four inter-related stages: production and storage (including seed selection from the plant), processing (including seed selection while degraining as well as food preparation) and final consumption, and is divided according to the stage of maturity (young cob/fruit and mature cob/fruit). Stages in turn consist of specific steps. Informants for this chain were Don Victor and Doña Francisca (F1), Doña Tiburcia and her daughter (F3), Don Fausto and Doña Auxiliadora (F4), Andres and Candita (F8) and Don Celso and Doña Paula (key informants).

Figure 4.1 Production-consumption chain for maize crop

All cultivars; most frequent forms of consumption. Sources: Interviews with informants and personal observations in Yaxcabá village; Cazares *et al.* 2002; Cazares and Duch forthcoming; and Terán *et al.* 1998.



- *Nixtamalization* is the main use given to mature grains regardless of colour (white, yellow, reddish, purple,black). In the case of purple maize ('Xhe ub'), it is mainly used for *tortillas* and, if available, for sauce/gravy in (Sp.) *relleno negro*, the favorite dish for great occasions (weddings, birthdays, etc.).

4.1.1 Production related characteristics

Maize yields shows that late maturing cultivars ('Dzit bacal' and Xnuk nal) have higher averages (up to 4.5 tons/ha) while the short maturing cultivars have the lowest (2.5 tons/ha) (Chavez-Servia *et al.* forthcoming), while there seems to be a preference for sewing landraces in rendzine soils (see Table 4.1). Men rather than women provided all criteria for production related characteristics (including as well water requirements and number of ears or cobs per plant) (Table 4.2). In spite of the fact that Xnuk nal and 'Dzit bacal' maize cultivars are likely to yield only one cob per plant, the data from Chávez-Servia *et al.* (Ibid.) shows that yields are higher for these cultivars. This may be related to the size of ears and number of grains and grain rows in these two landraces.

Table 4.1 Averages of performance of maize cultivar groups in agricultural fields in Yaxcaba, Yucatán, Mexico (adapted from Chavez-Servia et al forthcoming and Graefe 2001).

Cultivar group	Days to female blossom	Averages yields (Kg/he)			Preferred soil type*	
		In rendzine soils	In stony soils	Overall	Rendzine	Other
'Nal tel'	62 ± 6.8	2,553 ± 528	2,600 ± 456	---	X	
Xmejen-nal	66 ± 6.6	2,840 ± 342	2,260 ± 257	---	X	
'Dzit-bacal'	83 ± 3.0	3,605 ± 410	3,168 ± 397	---	X	X
Xnuk nal	83 ± 2.2	4,036 ± 407	3,402 ± 294	---	X	X
Local-crosses	72 ± 8.9	N/a	N/a	4,363 ± 536	X	
Imported group	74 ± 7.3	N/a	N/a	3,130 ± 520	X	
Averages	88 ± 7.0	3,385 ± 687	2,890 ± 587	3,940 ± 682		

* Data obtained from a single case (adapted from Graefe 2001)

Table 4.2 Ranking of maize production-related characteristics

Production related characteristics	Sex of informant	Ranking	Cultivar	Reasons
Rain dependant	M	XXX	Improved Xnuk nal 'Dzit bacal'	-Strongly relay on water in order to give fruits.
Number of ear/cobs per plant	M	XXX	Improved 'Nal Xoy' Xmejen nal 'Nal tel'	-Yield two and sometimes three ears per plant. The first two are considerable larger in size than the last two.
	M	XX	Xnuk nal	-Gives one ear.
	M	X	'Dzit bacal'	-If harvest succeeds, gives one ear.

Source: Field interviews

4.1.2 Storage and preservation steps: a male-female comparison

Maize storage in the Yucatan can be related to seed selection, since the first step in the storage and preservation stage begins at the moment of harvest when the best ears are left to fully mature on plants in the field. As Chávez-Servia *et al.* (forthcoming), reported, farmers are able to verify grain content and husk coverage by handling the cob; then they choose those ears that are full of grains with a husk that covers the complete cob since this helps to protect the grains from pest attack. In addition, farmers pay special attention to the size of the cob, with preference given longer ones.

Table 4.3 Ranking of maize cultivars in the storage stage of the maize chain

Storage Steps	Sex of respondent	Ranking	Cultivar	Reasons
Selection of ears on plant	M	XXX	Xnuk nal	-It does not become pitted; can safely stand in the plant for some months.
	M	XX	'Nal Xoy'	-As resistant as Xnuk nal but not always left in the plant for selection.
Immature ears in open box/basket w/o husk	Both	XXX	Xmejen nal 'Nal tel'	-Left for 2-9 days for immediate consumption.
	Both	XX	Any of the other	-May be left for a few days for immediate consumption.
Mature ears in sacks in kitchen w/o husk	Both	XXX	Xmejen nal 'Nal-tel' Improved	- Although priority is given to legumes, these two are better protected if stored near the wood stove's smoke.
	F	X	Xnuk nal 'Dzit bacal' 'Nal Xoy'	-Only if space is available these could be stored near the wood stove's smoke.
Mature ears in (Sp.) *trojes* in homegardens	M	XXX	Improved 'Dzit bacal'	-Depends on the availability of the space.
Mature ears at (Sp.) *trojes* in agricultural fields*	M	XXX	Xnuk nal 'Nal Xoy'	-It is the most cultivated maize by area; carried home in amounts of 1-2 sacks or as needed. -Depends on trust with neighbours (won't be stolen). -Resists weather inclemencies.
	M	X	Improved Xmejen nal 'Dzit bacal'	-Easily infested
Grain resistance (quality of grain)	Both	XXX	Xnuk nal 'Nal Xoy'	-Do not get pitted.
	M	XXX	Xnuk nal yellow 'Nal Xoy'	-Grains are more 'crystaline', then are heavier (weigh more) and more resistant to pitting.
	M	XXX	Xnuk nal white	-Grains are more 'floury', thus, dough and *tortillas* are softer and tastier
	Both	XX	Xmejen nal 'Nal tel' 'Dzit bacal'	-If it is not adequately stored, may become easily pitted.
	Both	X	Improved white	-Becomes pitted too soon.
Husk strength and coverage	M	XXX	Xnuk nal 'Nal Xoy'	-Thick husk (good coverage).
		XX	Xmejen nal 'Nal tel' 'Dzit bacal'	-Husk less thick than Xnuk nal but thicker than improved
			Improved	-Thin husk that may not cover ear tip.

After harvest, mature maize is usually stored in the fields on the cob in rudimentary granaries (Sp. *-troje* ; Mayan *-kubche)* made of thin sticks of wood and the leaves from a local palm called *guano* (Sabal spp.) where maize cobs with husks are vertically and tightly stored one after the other. Cobs are eventually carried to the house in amounts of one or two sacks at a time. Once in the house, maize cobs that still retain their husks may be left in the homegarden stored in another granary of the same kind together with limestone powder. Then, ears without husks might be placed in a closed plastic container together with a pesticide (i.e. in the form of tablets). Both limestone and pesticide are used to prevent pest attack. Ears either with husks or without husks are also often left in the sacks and stored either in the living room or in the kitchen. In the case of young ears, these are usually left in open boxes or baskets for consumption soon after harvest, since they are quite perishable (see pictures of these storage modes in the annex).

Women were able to provide relevant ranking criteria only for those storage steps that are related to maize stored in the dwelling, again suggesting gender divisions according to

spaces where, however, in this case the relevant production space is the dwelling rather than the production space. This is evident in that, even in the case of storage in granaries placed somewhere in homegardens, relevant criteria were given solely by men. Results show that maize cultivars with a short maturation cycle (Xmejenal, 'Nal tel' and, to a lesser extent, improved varieties), are quite perishable and are therefore stored inside the house, either for a few days while they are being consumed or, if there is space available, for longer periods in the kitchen. However, regarding kitchen storage space, priority is given to legumes: black beans (Phaseolus vulgaris), lima beans (P. lunatus) and cow peas (Vigna unguiculata), which are rolled in cloths and placed on top of the rudimentary stove around the roof so that the smoke serves to prevent insect infestation, particularly due to the high humidity levels in the environment. Rolling the young maize in cloth and placing it is also usually done by men, but women are free to use the young maize as needed. On the other hand, with respect to mature maize, farmers prefer to store in the field Xnuk nal, the maize cultivar with the longest maturation cycle (4 to 4.5 months) that also accounts for the largest percent of cultivated maize in terms of land extension. It is brought home in accordance with consumption needs or weather inclemencies. As Xnuk nal is also considered as '*our* maize' and, as will be shown below, is preferred by women by far for *tortilla* making (the most common form of consumption), the fact that men bring it home in relatively small amounts suggests a certain control that men have over the main or most valued staple, and to some extent, over women's labour as well.

4.1.3 Processing/food preparation steps: a male-female comparison

Processing and food preparation steps are closely inter-related: while the product is being processed, the person doing the task most of the time has in mind the final form of consumption as food. For 'processing' – presented as degraining (the removal of the kernels from the cob, a relatively laborious task performed by hand) in the table below - men only provided criteria for the 'degraining of mature ears', where they said that this step is easier in the case of Xnuk nal than for other cultivars while women were able to provide detailed rankings for degraining of both young and mature ears through to the 'quality of tortilla toasting' steps (Table 4.4). The relevance of both men's and women's participation in 'degraining of mature ears' for all maize types, together with the criteria about the quality of grain (Table 4.3 above), provide substantial evidence that both sexes are equally involved in the physical act of selecting a number of individuals (parents) to be used to generate a supply of seed for the next agricultural cycle. As Chávez-Servia *et al.* (forthcoming) indicated, the second 'moment' of seed selection for the upcoming season occurs a few weeks before the sowing period and consists of degraining the ear and selecting the largest non-pitted grains while discarding those on the base and the end of the cob. The research presented here on the production-consumption chain shows that usually men and women do the degraining task together around those dates, since while seed is selected for sowing, maize is also selected and processed for food consumption for the following days. It is important to mention that Xmejenal, 'Nal tel', 'Dzit bacal' and Xnuk nal (all landraces) are ranked higher for ease of degraining than 'Nal Xoy' (local cross) and improved varieties

Regarding food preparation steps, all criteria were provided only by women. There seems to be a marked difference regarding the colour of Xnuk nal in some steps (boiling and milling of mature ears/grains and quality of *tortilla* toasting), where the white expression is preferred by far over the yellow expression. Rankings seem to be influenced by the quality of *tortillas* that women try to achieve as this is the main form of daily consumption.[24] This is similar to the case of Mayan women from Cobán, Guatemala, where women influence seed selection presumably to achieve the desired quality of *tortillas* (Howard personal communication 2004 citing Johanessen 1982).

[24]Morley (1947), who carried out exhaustive anthropological and archaeological studies with his team across the entire Mayan region, found that 75 to 85 percent of the food consumed by modern Mayans consisted of maize in one form or another, where most of it is in the form of *tortillas*.

Table 4.4 Ranking of maize cultivars in the processing/food preparation stage of the maize chain

Processing steps	Sex of informant	Ranking	Cultivar	Reasons
Degraining of young ears	F	XXX	Xmejen nal 'Nal tel' 'Dzit bacal'	-Easy and fast degraining since ears have plenty of grains.
	F	XX	Xnuk nal	-Regular degraining.
	F	X	Improved 'Nal Xoy'	-Hard to degrain.
Degraining of mature ears	F	XXX	Xmejen nal 'Nal tel' Xnuk nal white	- Easy and fast degraining as ears have plenty of grain
	F	XX	'Dzit bacal'	-Although can be easily degrained as ears have plenty of grain, if the cob breaks (it is very thin), degraining becomes difficult.
	F	XX	Xnuk nal yellow	-Regular degraining.
	M	XXX	Xnuk nal	-Good degraining, not too soft, not too hard.
	F	X	Improved 'Nal Xoy'	-Difficult degraining
	M	XX	Improved 'Nal Xoy'	-Difficult degraining.
Food preparation steps				
Boiling time of young grains	F	XXX	'Dzit bacal' 'Nal tel'	-Becomes soft ina relatively short time.
	F	XX	Xmejen nal Improved 'Nal Xoy'	-Average time to be soft enough for consumption or further preparation.
	F	X	Xnuk nal	-Grains are too big to soften fast.
Boiling time of mature grains	F	XXX	Xnuk nal white 'Dzit bacal'	-Fast cooking; needs about five minutes. -Good cooking quality, does not become 'soupy'.
	F	XX	Xmejen nal 'Nal tel'	-Needs about eight minutes to become soft enough for milling.
	F	XX	Xnuk nal yellow	-Does not get 'soupy' but takes longer to cook than Xnuk nal white.
	F	X	'Nal Xoy' Improved	-Slow cooking time; needs about ten minutes.
	F	X	Maize from store (hybrid or improved)	-Becomes too 'soupy' in about 2-3 minutes; not good for tortillas.
Milling of young grains	F	XXX	Xmejen nal 'Nal tel' 'Dzit bacal'	-Grains are small and can be easily milled at home with the (small) grinding machine.
	F	XX	Xnuk nal	-Boiled grains are not as hard as those of improved and 'Nal Xoy'; nor as soft as the others. Industrial milling preferred.
	F	X	Improved 'Nal Xoy'	-Boiled grains are too hard for home milling machine. Thus, need to go to the mill and pay per kilo of ground maize.
Milling mature grains	F	XXX	Xnuk nal white	-Boiled grains not too hard and are excellent for *tortillas.*
	F	XX	Xnuk nal yellow 'Dzit bacal'	-Boiled grains as good as Xnuk nal white but taste and texture are not as good.
	F	X	Improved 'Nal Xoy'	-Boiled grains are quite hard. Thus it is necessary to go to the mill.
Easiness of shaping *tortilla* by hand	F	XXX	'Dzit bacal' Xnuk nal	-Soft to hand-shape.
	F	XXX	Xmejen nal 'Nal tel'	-Nice to hand-shape thick *tortillas* [(Mayan) *iswaaj*].
	F	X	Improved 'Nal Xoy'	-Dough is kind of hard; a bit dry.

Table 4.4 Ranking of maize cultivars in the processing/food preparation stage of the maize chain (continued)

Processing steps	Sex of informant	Ranking	Cultivar	Reasons
Quality of *tortilla* toasting	F	XXX	Xmejen nal 'Nal tel' Xnuk nal white 'Dzit bacal'	-Fast toasting. -Soft *tortilla* and *swaaj.*
	F	XX	Xnuk nal yellow	-Good toasting but *tortillas* are less soft.
	F	X	Improved 'Nal Xoy'	-Slow toasting.

Source: Fieldwork, 2003

4.1.4 Final forms of consumption and final destination: a male-female comparison

As in the maize processing stage, most of the relevant ranking criteria were offered by women. Men only provided some opinions for 'raw animal feed' and 'ceremonial uses' where nevertheless they did not make any relevant differentiation among maize varieties. Women, on the contrary, had a wide range of criteria reflecting differentiation between maize varieties according to a given use. In spite of the fact that there are about 10-15 common forms of use for the population under study, the daily and main form of consumption of maize is as *tortillas*, and as a beverage *(Mayan - pozol* or *keyem'*). Both forms are made with mature maize. When maize is seasonally available in an immature state, daily forms of consumption also include corn-on-the-cob and thick maize pancake (Mayan - *iswaaj*) which villagers prefer to eat in the evenings as a dinner meal.

Rankings in Table 4.4 show that, with only the exception of 'Xhe ub', any maize variety can be used in any form, although difference do exist among varieties. For instance, Xmejenal and 'Nal tel' are preferred for 'corn-on-the-cob' because of the softness of the grain which is due to its small size, as well as because of their taste. As villagers prefer consuming these maize cultivars in an immature state, they are also the highest ranked for the other forms of consumption immature maize consumption (*iswaaj* and *atole* beverages), although these varieties are not exclusive used for these. For the remaining common forms of consumption, the highest ranking was given to white maize cultivars which relates to aesthetic aspects of certain dishes and food items. For *tortilla*, the highest ranked variety is *Xnuk nal* in its white expression since it produces the highest quality *tortillas*. As indicated above, the case of Xnuk nal purple or 'Xhe ub' is a special one since it is the only cultivar that has an exclusive forms of use. It is mainly used is as an ingredient in the relish-sauce to make (Sp.) *Relleno negro'*, which is the dish that is far preferred for special occasions and celebrations; sometimes also used for a very highly appreciated 'pink coloured' *tortilla* or beverage.

Markets

Although markets have not been fully assessed in the work presented here since little was encountered, some maize varieties seem to have a higher demand than other varieties in local markets. These are Xnuk nal 'Xhe ub', which is used to make a gravy for the dish that is preferred for celebrations and special occasions, and 'Nal Xoy', a local cross from another village in the Yucatan that is cultivated only by a few farmers in the village but where other farmers acknowledge its good performance. Due to the relatively low production of maize compared to the high demands within the village, the maize market is predominately very local, which implies that buyers' criteria in the market are the same as for home consumption. On the other hand, when men and women were asked which maize varieties they would sell if there were a surplus, men seemed to be more oriented toward selling the yellow and long maturation cycle varieties since these are likely to weigh more. Women, on the other hand, mentioned a wider range of long maturation cycle varieties, purple and white Xnuk nal and Nal Xoy, where the first two are said to have a higher market price. Since the main sales

Table 4.5 Ranking of maize cultivars for final forms of consumption

Final forms	Sex of informant	Ranking	Cultivar	Reasons
Eaten as 'corn-on-the-cob'	F	XXX	Xmejen nal 'Nal tel'	-Taste -Softness
	F	XX	Any of the other	-All varieties may be consumed in this way (it is a daily form of consumption at the beginning of harvest season).
To cook thick maize pancake [(Mayan) *'iswaaj'*]	F	XXX	Xmejen nal 'Nal tel' Xnuk nal	-Taste -Quality of the pancake
	F	XX	Any of the other	-All varieties may be consumed in this way as it is a daily form of consumption at the beginning of harvest season.
To cook 'sweet atole nuevo'	F	XXX	Xmejen nal 'Nal tel'	-Taste
	F	XX	Any of the other	-All varieties may be consumed in this way as it is a daily form of consumption by the beginning of harvest season.
To cook 'sour atole nuevo'	F	XXX	Xnuk nal white	- Aesthetics of the maize drink (white looks nicer)
		XXX	Xmejen nal 'Nal tel'	-Taste
	F	XX	Any of the other	-All varieties may be consumed in this way as it is a daily form of consumption at the beginning of harvest season.
Animal feeding (raw)	F	XXX	Any maize	-Do not need to be stored
	M	XXX	Any maize variety	-Use of ears that became hollow -Use of tip grains (discarded as seed)
To cook Maize cake [(Sp.) *'tortilla'*]	F	XXX	Xnuk nal white	-Tortilla is soft -Best taste in tortilla and *pozole* drink. - Aesthetically pleasing in this food form
	F	XX	Xnuk nal yellow 'Dzit bacal'	-Taste and texture not as excellent as Xnuk nal white
	F	XX	Xmejen nal 'Nal tel'	-Preferred to be eaten in young state
	F	X	Improved 'Nal Xoy'	-Tortillas not very soft -Taste not as good the highest/intermediate rated.
	F	X	Maize from store	-Littledough yield -Taste not as good the highest/intermediate rated.
To cook 'tamales'	F	XXX	Any white	-Aesthetics of dish (*tamal* looks nice with the red stew on top of the white mass)
	F	X	Yellow maizes	-Not aesthetically pleasing in this food form
As relish-sauce in regional dishes	F	XXX	Any white	-Aesthetics of dish (*tamal* looks nice with red stew on top of the white dough)
	F	X	Yellow maizes	-Not aesthetically pleasing in this food form
As relish-sauce for (Sp.) *'relleno negro'*	F	XXX	'Xhe-ub'	-Aesthetically pleasing in this food form
	F	X	Any of the other	-If 'Xhe-ub' is not available, any maize can be used. -May be anti-aesthetic as the black dish becomes whitish.
To prepare maize beverages	F	XXX	Xnuk nal white	-It does not breaks when boiling - Aesthetically pleasing in this food form -Fast cooking time
	F	X	'Nal Xoy'	-Slow cooking time, needs about 10 minutes
Ceremonial use	Both	XXX	Any maize variety	-Depends of the dish/beverage offered
	M	XXX	Xnuk nal white	-To prepare (Mayan) *'saka'* (sacred beverage)

point of sales is the house itself, women have a certain degree of ability to market the maize produced in men's fields. For instance, if people stop by the house to buy maize, the woman is generally allowed to sell some of the product even if the man is not present. However, if the person wanting to make a purchase is a man, he may never stop by house if the male head of household is not present since is not seen to be appropriate.

4.2 The squash production-consumption chain and cultivar ranking

As in the case of maize, both men and women who are known for cultivating a relatively high number of varieties were first asked which squash cultivar was the best, which was regular and which was the worst for a given step in the production-consumption chain. No pair-wise comparisons were necessary since one of the families interviewed cultivated all four squash varieties identified in this study (F6). Informants for this section were Chona and Tonino (F2), Doña Tiburcia (F3), Doña Juanita (F7), Doña Elide and Don Florencio (F6) and Don Mariano Cob (key informant).

Figure 4.2 provides an overview of the production-consumption chain for squash according to the main forms of consumption. Most of these uses are considered to be unique to the area. The chain consists of four stages: production, storage, processing and final forms of consumption, and is divided according to the parts of the fruit that are used for food preparation (flowers, fruit and seed).

4.2.1 Production related characteristics

Data from previous research in the village (Canul *et al.* 2000; Canul *et al.* 2002) shows that, in spite of differences in fruit yields between 'Xnuk kuum' and 'Xtop' (where the latter is not used in a mature state since it becomes fleshless) as well as in maturation time, seed amounts in both species are relatively similar. For the rest of the criteria about production related-characteristics and quality of the product, in distinction to maize, women had more criteria for ranking squash cultivars than men (Table 4.7). Indeed, men's criteria were expressed mainly for 'Xnuk kuum' and 'Xtop', the squash cultivars that are normally grown in fields[25] and which, when intercropped, serve to conserve moisture for maize plants while yielding a good number of fruit, and whose seed has high market value.

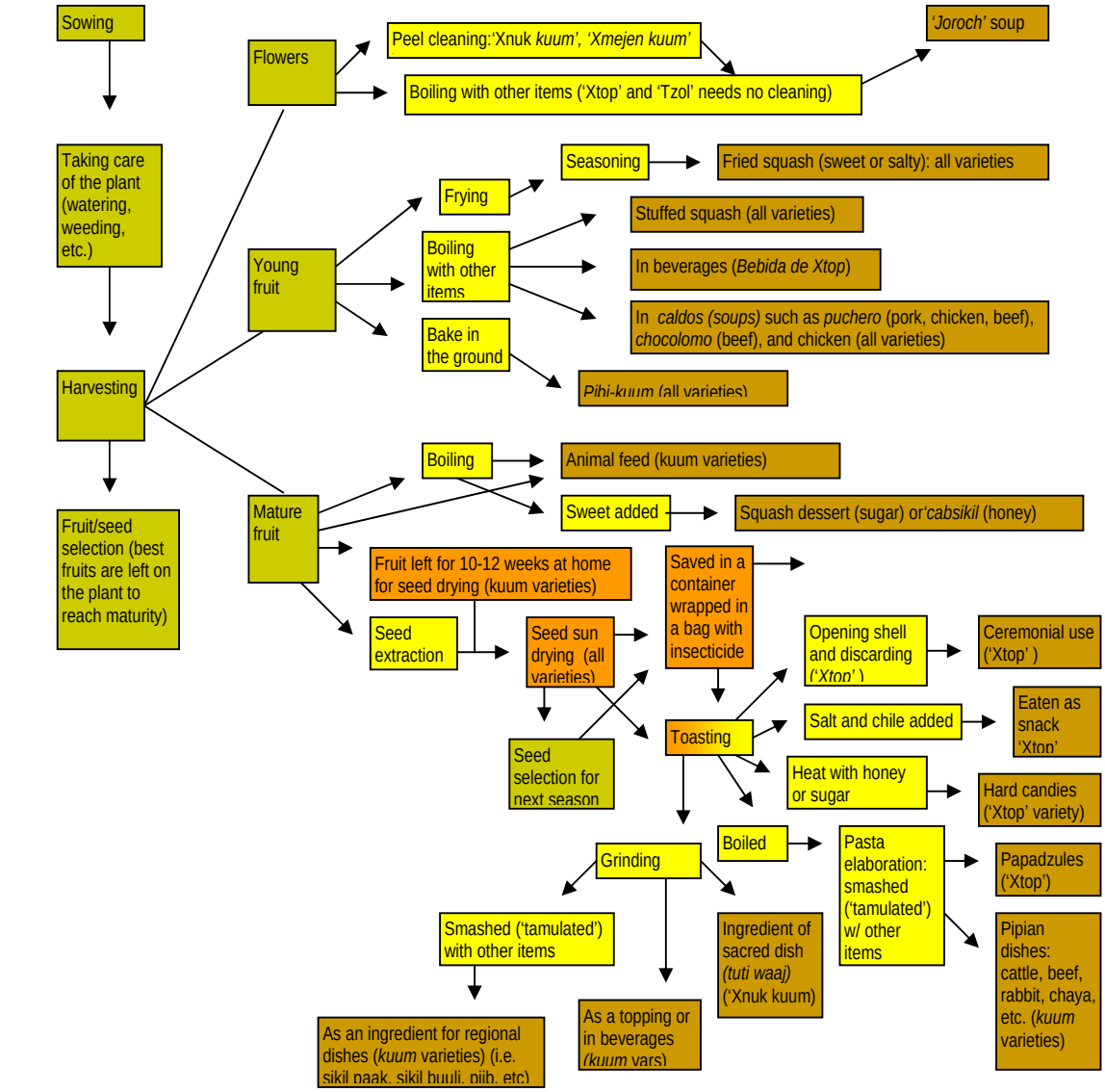
Ranking differences were mainly found between 'Xmejen kuum' and 'Tzol', on the one hand, and 'Xnuk kuum' and 'Tzol', on the other. For instance, the former two squash varieties require more delicate plant management and care and young fruit are of higher quality due to the softness of the flesh, while the latter two varieties require less plant attention and mature fruit have an abundance of seed per fruit (about 200-250 grams). For all four squash varieties, it seems to be an advantage to have fruits available nearby the house at cooking time. Table 4.7 provides further details regarding ranking of squashes in production steps.

4.2.2 Storage and preservation steps: a male-female comparison

For all four cultivars, some squash fruits are left on the plant to reach maturity. Then, fruits are harvested and kept at home whole (with the seed inside) for some time. After that, the seed is removed and placed on paper or on a cloth in the backyard or front of the house to sun dry for about 1.5 to 3 days depending on the variety. Once the seed is dried, it is rolled in paper or cloth with some ash inside, and then placed in a container and kept somewhere in the kitchen. If the squash was produced in fields, men usually bring the fruits home where seed extraction can be done by both men and women. Seed sun drying is considered as a woman's task. On the other hand, it was reported that, some decades ago, it was a common practice to extract the seed of 'Xnuk kuum' in the field where the flesh was discarded and only the seed was brought home. However, as some in the village said, all of the squash can be used in one form or another, so nowadays men usually bring the whole fruit home in spite of the fact that it may represent more work. From the sample in this study, only Don Fausto (F4) leaves most of the 'Xnuk kuum' fruits in the fields, bringing only the seed home.

[25]In the research sample, 'Xtop' was scarcely found in agricultural fields; however, it was reported that many people in the area produce this cultivar in fields.

Figure 4.2 Production-consumption chain for squash: all cultivars by most frequent forms of consumption



Sources: Interviews with informants and personal observations in Yaxcabá village; Cazares *et al.* 2002; Cazares and Duch forthcoming; and Terán *et al.* 1998.

Table 4.6 Ranking of squash cultivars in the production stage of the chain

Production related characteristics	Sex of informant	Ranking	Cultivar	Reasons
Yield (fruit) kg/ha*	Field measures	XXX	'Xnuk kuum'	11732 +/- 725
		X	'Xtop'	8080 +/- 241(fruit only used in immature state)
		N/a	'Xmejen kuum'	N/a
		N/a	'Tzol'	N/a
Yield (seed) kg/ha*	Field measures	XXX	'Xnuk kuum'	385 +/- 117
		X	'Xtop'	416 +/- 100
		N/a	'Xmejen kuum'	N/a
		N/a	'Tzol'	N/a
Maturation time in days*	Field measures	N/a	'Xnuk kuum'	83 to 99 days
		N/a	'Xtop'	48 to 58 days
		N/a	'Xmejen kuum'	N/a
		N/a	'Tzol'	N/a
Soil moisturing	M	XXX	'Xnuk kuum' 'Xtop'	-Leaves help to retain moisture for maize plants in intercropping.
Plant needs for attention and care before harvest	F	XXX	'Xmejen kuum' 'Tzol'	- Needs to be watered and tackyweeds must be removed, otherwise cooking quality is not as expected.
	F	XX	'Xtop'	- Still needs to be cared for (water and weeding removal) but not as delicate as 'Xmejen kuum' and 'Tzol'.
	F	X	'Xnuk kuum'	-If there is good rain, they grow with no problem.
Other characteristics:				
Quality of young fruits	F	XXX	'Xmejen kuum' 'Tzol'	-Soft flesh. -Soft peel.
	F	XX	'Xtop' (xcaita) 'Xnuk kuum'	-Less soft than the others.
Quality of mature fruits	Both	XXX	'Xnuk kuum'	-Gives plenty of seed. -Flesh can be consumed (by both animals and humans) -Preferred form of consumption
	Both	XXX	'Xtop'	-Gives plenty of seed. -No flesh to consume (neither by animals nor humans).
	F	XX	'Xmejen kuum' (Xplato named in mature state)	-Seed not as abundant as Xnuk kuum -Aesthetics of the fruit.
Quality of seed	Both	XXX	'Xtop' 'Xnuk kuum'	-Large seed. -Taste of seed. -Abundance of seed.
	F	XXX	'Xnuk kuum'	-Versatility of seed use.
	Both	XX	'Xmejen kuum'	-No seed abundance as Xnuk kuum. -Taste of seed.
	F	XX	'Xmejen kuum'	-Versatility of seed use.

Source: Canul *et al.* 2002 and field-interviews

For ranking in storage steps among squash cultivars, women had more criteria than for maize. For both men and women, the 'Xnuk kuum' fruit seem to be the easiest to store since as seed can be left inside the fruit for several months. Usually the whole fruit is kept somewhere in the kitchen (i.e. just left on the floor). The same applies to other cultivars, but these can be left for a shorter period of time. Ranking differences exist in seed sun drying according to the cultivar.

4.2.3 Processing/food preparation steps: a male-female comparison

After the seed is sun-dried, if it is not to be immediately consumed, it is stored. If it will be processed for consumption, it is toasted in the rudimentary stove. Seed of 'Xnuk kuum' and

Table 4.7 Ranking of squash cultivars in the storage stage of the chain

Storage Steps	Sex of informant	Ranking	Cultivar	Reasons
Seed left in dry fruit	Both	XXX	'Xnuk kuum'	-Safe to leave seed in this way for several months. -Flesh can be then used for animal (pork) feeding.
	Both	XXX	'Xmejen kuum' 'Xtop'	-Safe to leave seed in dry fruit for days or weeks.
	F	X	'Tzol'	-Seed left in dry fruit only the time needed to save seed for the next sowing.
Seed sun drying	F	XXX	'Xmejen kuum'	-Dries faster (less than two days).
	F	XX	'Xtop'	-Dries in about two days.
	F	X	'Xnuk kuum'	-Needs two days or more to sun dry.
	F		'Tzol'	-Seed is only sun dried to keep for next season. Takes no longer than two days.
To save wrapped in container	Both	XXX	All are the same	-Seed well preserved if wrapped in paper and ash added as an insecticide.

'Xmejen kuum'[26] does not have to be shelled, but 'Xtop' has to be shelled for processing and consumption.[27] All seed can be either consumed at this step as a snack with salt and chile or can be further processed: grounded either in a rudimentary wood or stone bowl or in a hand-milling machine. As shown in Table 4.8, all relevant ranking for squash processing was solely provided by women where toasting seems to be the same for all four cultivars while grounding is more difficult for 'Xtop' due to the size of the seed. It is relevant to mention that seed of 'Tzol' is only dried to conserve as seed for next season; never toasted and grounded.

Another part of the squash that is frequently used in the area consists of the flowers. Some women within the sample said that only the flowers of two squash cultivars can be used to eat while other women said that all of them can be used but that some of them require 'pungency cleaning' (removal of small 'hairs' within the flower peel). The 'kuum' varieties were the less rated for this processing steps.

Table 4.8 Ranking of squash cultivars in the processing stage of the squash chain

Processing Steps	Sex of informant	Ranking	Cultivar	Reasons
Cleaning of flower peel	F	XXX	'Xtop' 'Tzol'	-Need no cleaning, thus is preferred for flowers
	F	X	'Xmejen kuum' 'Xnuk kuum'	-Requires laborious cleaning, thus is almost not used for flowers
Seed toasting	F	XXX	'Xnuk kuum' 'Xmejen kuum' 'Xtop'	-All three are the same
Seed grounding	F	XXX	'Xmejen kuum' 'Xnuk kuum'	-Easy to grind (seed smaller than 'Xtop')
	F	X	'Xtop'	-Hard to grind (seed bigger than the kuum varieties)

4.2.4 Final forms of consumption: a male-female comparison

Men only had preferences criteria for squash cultivars for forms of final consumption in relation to ''animal feed' and ''ceremonial uses'', and these criteria did not differ substantially from women's criteria for these same forms of consumption. In general, two of the squash

[26] Consumption of 'Xmejen kuum' seed is not as frequent as that of 'Xnuk kuum'. This because the latter contains considerably larger amounts of seed than the former, while the former is also preferred to be eaten in young state due to the softness and taste of the fruit.

[27] For instance, during the 'Mayan Baptism' ceremony, 'Xtop' seeds are cracked opened as a symbol of the opening of the mind of children to God (Terán *et al.* 1998).

cultivars are highly preferred for at least one form of use according to its unique characteristics. That is, these cultivars have exclusive forms of use. For instance, 'Xnuk kuum' is the only variety whose seed can be use for elaboration of the (Sp.) *pipian* dishes while 'Xtop' seed is used for the sauce in a regional dish called (Mayan) *papadzules*. Regarding the other two squash varieties, 'Xmejen kuum' and 'Tzol', the latter is considered as the best to eat boiled or in soups; however, since it is barely found in the area, 'Xmejen kuum' has become by default the squash that is used for soups. Further details are provided in Table 4.9.

Table 4.9 Ranking of squash cultivars for final forms of consumption

Final forms	Sex of informant	Ranking	Cultivar	Reasons
To cook (Mayan) *'joroch'* soup	F	XXX	'Xtop' 'Tzol'	-Flower have no pubescence
	F	X	'Xnuk kuum' 'Xmejen kuum'	-Flowers are full of pubescence (tiny hair)
To eat fried	F	XXX	'Xnuk kuum' 'Xtop'	-Nice taste -Fruits abundant
In 'soups'	F	XXX	'Tzol'	-Finest flesh -Best squash to be eaten in soups
	F	XX	'Xmejen kuum'	-Fine and soft flesh -Nice taste
To cook 'stuffed'	F	XXX	'Xnuk kuum'	-The size and shape allows it to be stuffed while still immature.
In beverage	F	XXX	'Xtop'	-Taste (only in immature stages).
In hard candy	F	XXX	'Xnuk kuum'	-Best seed for this candy.
(Mayan) *cabsikil*	F	XX	'Xmejen kuum'	-Is used only if seed from 'Xnuk kuum' is not available.
To cook (Sp.) *calabaza melada*	F	XXX	'Xmejen kuum'	-This is the most appropriate for making this sweet (no other squash is used in this form of consumption).
Animal feeding	Both	XXX	'Xnuk kuum'	-Is the most abundant squash. -Has abundant flesh.
	Both	XX	'Xmejen kuum' 'Tzol'	-Only given to animals if harvest has failed
	Both	X	'Xtop'	-Considered harmful to animals; may develop a bacteria (Trichinosis) if ingested
To eat as snack w/salt & chile	F	XXX	'Xtop' 'Xnuk kuum'	-Nicest taste. -Very nutritious. -Children like it a lot.
To cook (Mayan) *'papadzules'*	F	XXX	Xtop'	-It is the only seed used to prepare the sauce for this dish. -Unique taste.
To cook (Sp.) 'pipian'	F	XXX	'Xnuk kuum'	-Best seed for *pipian* dishes; unique taste.
	F	XX	'Xmejen kuum'	-Used if Xnuk kuum seed is not available.
Item in regional dishes or topping in beverages	F	XXX	'Xnuk kuum'	-Unique taste.
	F	XX	'Xmejen kuum'	-Used if 'Xnuk kuum' seed is not available.
Ceremonial use	F	XXX	'Xmejen kuum'	-Seed used in dishes and candies offered during Death's Day celebration and in the pancakes made for Rain-Making petition.
	M	XXX	Any variety	-Depends on the ceremony's offering [(Sp.) *'ofrenda'*]

Markets

As previously mentioned, markets have not been fully assessed in the work presented here. However, data gathered and day-to-day observations suggest that the squash market is predominately local, which implies that selection criteria are the same in local markets as in home consumption. Either men or women may have more control over marketing, depending on the squash cultivar and the part of the plant involved: if it is the fruit, men are not involved, whereas if it is seed, men may have most control. Marketing of fruit is usually done from the home: women may stop at the house or garden of another women to buy

squash. In the case of 'Xmejen kuum', it is frequently found at small market points all around the village where it is brought from other villages. Marketing of squash seed can be either very local or regional. People (men and women) may stop at the house to buy seed but, as is the case with maize, a man won't stop to buy if the man of the house is not there. In addition, a small number of families that have produced enough seed of 'Xtop' and 'Xnuk kuum' may take it to a regional (urban) market where it is very valued since it is a unique ingredient of some regional dishes.

4.3 Conclusions

Throughout this chapter it has been demonstrated that varietal selection criteria are determined by a wide range of factors such as knowledge, labour, plant characteristics, processing characteristics, storability, preservation methods, available technology and environmental factors. Indeed, each of these pertain to the different steps within the production-consumption chain, where in turn specific criteria are determined according to the moment (i.e. harvest, post-harvest) and the space (i.e. fields, the house, the kitchen) which are also gendered. That is, either men or women may predominate at either earlier or later stages, and in the field or the house or the kitchen or the (out-of-town) market, or any other space.

Findings have shown that, in the case of maize for instance, men are likely to continue to maintain a cultivar which they have previously managed and therefore, they are knowledgeable about the techniques required to achieve the best agroecological performance and extended storage life, where the available technology and environmental factors such as soil type, temperature and humidity are key determinants of men's criteria. In regard to these requirements and to the technical and environmental knowledge held which has been transferred from generation to generation,men by far prefer landraces over local crosses and improved populations (imported group). Women's selection criteria for maize are influenced by factors related to processing and food preparation characteristics and preservation methods, the available technology and environmental factors which are in turn related to specific forms of food. For example, women may prefer a given variety for the shorter cooking time, the ease of degraining and/or the possibility to grind it at home rather than at the mill (and therefore saving money); women leave the maize dough at room overnight in order to obtain a sour flavour - the product of fermentation - that is required for a maize beverage and some forms of maize cake. Women also prefer landraces over other maize varieties for processing and preparation. Regarding squash, men are only involved in the selection of the two squash varieties that are usually grown in the fields. It seems that men select these two squash cultivars because of the agroecological advantages that they represent for maize production and because of the market value of the seed. On the other hand, women's selection criteria regarding the four squash cultivars identified in this research were dominated by the uses related to each of the cultivars, which indeed requires a high degree of technical and environmental knowledge.

The crucial importance of the domestic sphere as a realm of crop diversity promotion and conservation is supported by studies done in other areas of the world, as discussed in Chapter 1. In spite of the limitations of the data on varietal selection criteria presented in this chapter, the data that could be generated, together with the data on the production-consumption chains, reveals a gender division of labour according to stages within the chains, as well as gender differences in both the number and type of varietal selection criteria that correspond to each sexes' involvement in, and the nature of, the different steps in the chain. Post-harvest steps and final forms use have definite associated criteria that appear to be reflected in the selection and maintenance of varietal diversity in the village, apparently at least as much if nor more than as agronomic conditions or steps in the crop production alone, but this will be discussed in more detail in the concluding chapter when considering the data generated in chapters 3 and 5. Data presented in this chapter have suggested that, in

addition to agroecological influences, diversity in both squash and maize cultivars is likely to be promoted because of specific characteristics that may make certain cultivars more suitable for a given step within the production-consumption chain, where men may predominate more in production steps while women may have a primary role in post-harvest management. Indeed, each has to some extent differing criteria and the question becomes, how do each influence varietal selection in the different production spaces, when these are traditionally defined as either male or female, but not both? Chapter 5 further explores this issue.

5 GENDER RELATIONS AND GENDER NORMS: DECISION MAKING AND INFLUENCES IN VARIETAL SELECTION

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> For a good harvest, offerings and rituals must be made…The Mayan Gods and Goddesses [(Mayan) *Yumsilo'ob)*] provide water that gives us food from our fields… encountering our fields full of our fruit is encountering ourselves, our beliefs, our traditions…. (Don Mauro, August 9, 2003, Event for the International Day World's Indigenous People celebrated in Yaxcabá, Yucatán).

5.0 Introduction

Varietal selection in the work here presented has been approached as a negotiation process between men and women in the farm household rather than as the physical act of selecting a number of individuals (parents) to be used to generate a new supply of seeds (offspring) in the next crop cycle, which has been researched in other contexts in México (Aguirre *et al.* 2000; Smale personal communication 2004 citing Bellón 1991; Ibid citing Bellón and Taylor 1993; Ibid citing Bellón and Brush 1994; Ibid citing Louette and Smale 2000; Ibid citing Louette *et al.* 1997; Ibid citing Perales *et al.* 1998; Ibid citing Van Dusen 2000; Ibid citing Dyer 2002). This chapter focuses on gender interactions and men and women's negotiations regarding decisions about varietal selection according to different production spaces. It was posited that varietal selection is influenced by the gender division of labour. However, the gender division of labour itself is defined by gendered norms and power relations that are intrinsic to and manifest in nearly all social, economic and cultural spheres, such as rights and property relations, and cosmology.

Feminist theory explores how gender relations and gendered norms constitute relations of power that systematically lead to inequalities, particularly in both patriarchal and capitalist societies (Kabeer 1994). According to Kabeer, contrasting with contemporary market-based societies, in pre-capitalist societies, the domestic sphere was the primary site of most social relations, including gender relations. The family thus might be the first domain where norms that originate at macro-level (e.g. society, the State) are transferred into the individual according to what is 'correct'. Kabeer further argues: 'Family and kinship relations are systems for organizing rights, responsibilities and resources for different categories of members in different social groups. Relationships in the family are governed by 'social rules' which determine how assets are to be distributed between the occupants of different relationships, how authority and status are to be assigned and how labour is allocated (1994:58). Practices thus take on normative significance so that values become embedded in the tasks and in who does them, leading to powerful norms of masculinity and femininity where gender identities are so deep-rooted in people's consciousness and sense of belonging, that they are transmitted from generation to generation and are frequently uncontested (Ibid.). In addition to socio-cultural and economic factors, another aspect to consider as a determinant of gendered norms and power relations is that of cosmology. From ancient times, the Maya had a well-defined gender division of labour (see De Landa 1566 in Baeza *et al.* 2003) while recognising feminine and masculine polarities in the surrounding world, for example, by showing respect and veneration to both male and female deities. As in other areas of Mexico, there is a strong link between cosmology and the gender division of labour, manifested through customs or traditions handed down by ancestors where the continuity of customs and rituals seems to be taken for granted without need of an explanation for those following them (Govers 1997).

One clear realm in which gendered norms are formulated and transmitted is through cosmology, which is also a defining aspect of ethnicity. The Yucatec Mayas traditionally have their own way of seeing and interpreting the world, which is strongly related to the norms and values that guide their lives and their relationships with other living beings and objects with which they interact. The importance given to crop genetic diversity is also related to Mayan cosmology. For instance, ancient Mayas conceived the origin of the cosmos, and the order and course of nature, within a plethora of deities who create the human race from maize (*Popol Vuh* 2001ed.). As in other areas of Mexico (Govers 1997),

there is also a strong link between cosmology and the gender division of labour, manifested through customs which are traditions handed down from the ancestors.

The chapter here presented deals with men and women's decision making and decision making power with regard to the selection of a given cultivar for cultivation in a given production space in accordance with their specific selection criteria. All of these are understood at least in part as a manifestation of gender relations (although other social relations may also be entailed that are for example age, kin or income-related, or simply based on individual idiosyncrasies), which are indeed strongly conditioned by gender norms. Both men and women responded to open-ended questions regarding decisions made about varietal selection, production and final destination of the products (the domestic sphere and markets). This included further probing to identify: what is considered to be both men's and women's appropriate behaviour in different production spaces; how the requests and preferences expressed by women are regarded by men and *vice versa*. All of these questions were approached from an emic[28] perspective. Results are presented according to an ethnographic format, describing the cases by family. They suggest that men and women are not separate decision making entities regarding what to grow in what amounts in a given production space, nor regarding the destination of the product, but rather that the interests of both are considered and reflected in all respects. However, differences do exist between the two species under study and according to production space, which are indeed related to norms regarding the 'appropriate' behavior of men and women.

5.1 Desires, requests and decisions about cultivars in production spaces: negotiations between men and women

5.1.1 Family 1 (Cob-Balam)

> 'The maize plants belong to her. I only provide my labour. I gave the improved seed to her…we have sown some of this maize in the field but she still wanted to have some in the homegarden. It is the first year we have it and we want to see how good it is… She has sown the maize here in the homegarden as we have some space since the animals we had were sold after the hurricane… (Don Victor)

Through Don Victor's testimony, the authority and decision making that his wife has in the homegarden can be inferred. Although it is implied that it is 'her production space', this does not mean that he is excluded. His labour might not be indispensable; however, he is expected to carry out some 'masculine' tasks, such as feeding cattle. This also testifies to the trust that Don Victor has in Doña Francisca's knowledge, labour and skills, as well as the acceptance of her desire for and request to have maize sewn in the homegarden. Evidence about the complementarity between homegardens and agricultural fields is as well provided: they are comparing their respective trials. Moreover, this testimony supports the idea that homegardens serve as a 'genetic backstop' during periods of crop failure or disruption, and as sites of experimentation with new varieties, as Niñez argued (1987).

Family 1 is one of the two families where the gender division of labour seems to be stricter. Don Victor and his three unmarried sons (ages 24, 27 and 28) are in charge of the agricultural field work while Doña Francisca and her four daughters (ages 11, 12, 16 and 18) are in charge of domestic tasks, which include food processing and preparation and work in the homegarden. Women only go to the fields on special occasions and the only man who

[28]Emic and etic: dialogic concepts used to interpret social phenomena. Emic refers to the internal and culturally defined, while etic refers to the constructed view from an objective or scientific perspective. The emic/etic distinction is one of the basic contributions of modern anthropology to the understanding and interpretation of other cultures and groups and their differing perceptions of reality (Headland 1990).

does some work in the homegarden is the male head of household. No man in this family is involved in food processing or preparation steps other than occasional maize degraining.

Homegarden
Most of the labour in this space is carried out by girls and women, while the male head of household's main responsibility in this space consists of feeding 'his' cattle. The sons, who work in the fields, have no tasks in the homegarden. The cultivation pattern seen in this homegarden seems to be the outcome of the decision of both Don Victor and Doña Francisca. They have a special area to experiment with an improved maize cultivar which is quite visible from outside the garden and of which Doña Francisca is very proud. She wanted to produce this maize and her husband gave her the seed. They both wanted to try the cultivar but she finds it quite advantageous to have the variety nearby. 'Xnuk kuum' squash has grown by itself but they both have agreed on leaving some area free for further planting. In one area, Don Victor has his cattle and in another, they are both constructing a chicken coop, an activity that has recently been promoted by a political party's local council.

Agricultural fields
In comparison with data available on this household from two years ago (Lope *et al.* 2001; Interián 2001) and five years ago (Morales and Quiñones 1999), this family seems to have increased both the land area cultivated and the number of maize cultivars grown. This seems to be related to the availability of male labour force in the household as the two older sons, now present, were working in the Caribbean tourist area during previous years. The maize diversity present consisted of Xnuk nal 'Sac nal' (white), Xmejen nal 'Xhe ub' (purple) and 'Can nal' (yellow), Improved and Nal-Tel. The last cultivar was being tested for the first time (it was given to the male head of household by a researcher).

Doña Francisca prefers a lot Xnuk nal and Xmejenal due mainly to its processing and food preparation qualities, while Don Victor not only appreciates these varieties for these and other reasons, but also wishes to cultivate them because the seed was inherited from his father, who he says inherited the seed from his grandfather. In the case of the improved varieties, it seems that Doña Francisca encourages her husband to grow this kind of maize in relatively large amounts as it can be used for daily consumption in forms other than *tortillas* (for beverages and animal feed). Both the head of household and his wife agree upon growing relatively large amounts of 'Xmejenal', 'Nal-tel' and even improved maize due to the short maturation cycle of these varieties, which is a means to assure that maize is available in a relatively short period of time.

In addition to the desired agronomic qualities obtained by intercropping 'Xnuk kuum' and 'Xtop' squash cultivars with maize, the production of both squash varieties seems to be strategic for this family. Both are highly valued by Don Victor and Doña Francisca not only for their diversity of uses, but also because the seed represents ready cash as people in the village know that they often have seed to sell. Indeed, the only maize and squash products that they sell are seed squash and a small amount of Xmejenal 'Xhe ub' (purple).

Varieties they would like to have
Don Victor said that he has all of the maize and squash varieties that he likes. Doña Francisca, on the other hand, said that she would like to have 'Xmejen kuum' squash; but they have never had the seed and if they could have it, she would grow this squash in the homegarden so that she could take good care of the delicate plants.

5.1.2 Family 2 (Pech-Tamay)

> 'Chona likes white Xnuk nal very much. Every year she asks that it be sown it in good amounts so that we have enough to eat and, if possible, to sell as it obtains a good price of $2.50 pesos or more [about $0.30 US dollars], so I have my 50 mecates full of

> Xnuk nal 'Sac nal ['white]…I do not grow the Xnuk nal 'Can nal' [yellow] that my parents and sister who live next door have because here in the house we prefer the white over the yellow: the dough is better…the maize cake is softer… For yellow we have Xmejenal in the community plot… Chona wanted to cultivate some Xnuk nal white in the homegarden, but I wanted to put some Improved seed I got last year there so I don't mix it with the other varieties … and my white Xnuk nal gets really white…. '

Tonino is not acknowledges his wife preferences but shares her criteria. Therefore, he takes into consideration her request as he agrees with the reasons that she gives. For her part, Chona not only values Xnuk nal for its tortilla-making qualities, but also for the potential income that she could obtain if she had this maize landrace in her space. The complementarity among the household's three production spaces is also evident. Tonino only produces one type of maize per space as means to maintain the genetic purity of the cultivars.

This is one of the two youngest families in the research sample. Chona is in charge of domestic tasks, occasionally helped only by her oldest (eight year-old) daughter. Tonino works as a policeman in town. Chona's grandfather helps them with agricultural labour in fields in exchange of daily meals (he is a widowed). The main source of income for this family consists of the employment of the man.

Homegarden

In spite of the fact that Chona would like to have Xnuk nal as a potential source of income, Tonino had the final word in deciding to grow the improved variety in this space. However, Chona does not seem to feel deceived or angry about Tonino's decision. Indeed, she seems to provide her labour and care with gusto and pride. She knows that he trusts her work and they both like to have this cultivar because of the big ears that can be harvested in a relatively short time. Chona prepares it mainly in beverages. Squash 'Xnuk kuum' has been grown in the space for the past nine years, since they were married. Sometimes Chona has sown it, sometimes Tonino, and sometimes the plants just appear there, grown from discarded seeds. Having squash in the homegarden is an advantage that Chona openly recognizes. She can have food nearby all year long, not only for human consumption but also for feeding animals.

Agricultural fields

In spite of the fact that Chona only accompanies Tonino to work in the field about once a week during the bean harvest, the requests she makes about varietal selection are reflected in this space. Only Xnuk nal 'Sac nal' [white] and 'Xnuk kuum' squash are grown in this family's single agricultural field. Chona explicitly asks Tonino to continue to sew the white Xnuk nal as it is the best for dough and *tortilla*s, a request that Tonino said he is glad to fulfil since he also prefers tortilla made with this maize. 'Xnuk kuum' squash is grown only in some areas within the field - not enough to sell, but enough for the family to eat and to feed animals.

Community plot

A piece of land was granted to this family about three years ago located at about 200 m from their house. Here they are growing Xmejen nal maize and almost all squash cultivars found in the area ('Xnuk kuum', 'Xtop', 'Tzol' and 'Chuuk kuum'). Maize was sown by Tonino and Chona's grandfather and the squash has been grown by the two of them and Chona. Chona constantly insists on keeping the highest diversity of squash in this space. In contrast to the agricultural fields, she goes every day to collect food either alone or accompanied by Tonino or her children. Moreover, even when the cropping pattern in this production space, resembles that of the agricultural field, Chona expresses a greater sense of ownership about both the land and the plants in this space in comparison with the field. However, this does

not mean that Tonino is excluded from the community plot. Indeed, they both seem to freely demonstrate a concept of equality in this space, for instance, for varietal selection.

Varieties they would like to have
Tonino said he would like to have both 'Nal Xoy' and a kind of yellow improved variety that he has seen in the village. He has never had the seed and finds that it is too difficult to obtain it; people who have it do not share. If it were available, he would grow it in a new agricultural field. Tonino also said he would like to have a kind of 'Xnuk kuum' which at the time to harvest weighs about four kilos (the whole fruit, including seed). Chona, on the other hand, would like to have white 'Xnuk nal' in the homegarden so she can easily sell it, although Tonino preferred to keep that maize in the field and the improved maize in the homegarden, for family use. However, Chona seems to gladly accept the reasons he has for such a cropping pattern (maintaining the purity of the race).

5.1.3 Family 3 (Pech-Cab)

> 'Usually when a few sacks of maize from a previous harvest are left, we start to separate several kilos of the best grains for sowing in the fields …For fields we like a lot of both, yellow and white Xnuk nal… He likes the yellow more because of the weight. I like the white more because of the colour and softness of the dough…We agreed upon growing half and half… (Doña Tiburcia)

Doña Tiburcia gave a clear insight as to how she and her husband are equal regarding varietal selection in agricultural fields. They both select seed and they both explicitly agree upon what is going to be grown and in what amounts in the field. They both take into consideration the interests of the other. Her knowledge and skills must be emphasized, however, since he is unable to carry out much of the work in the field. As data below show, varieties grown in the field are not the same as in the homegarden, suggesting the complementarity of production spaces.

This is household conformed by an elderly coupled who are the parents of Tonino (F2). Don Crisanto is very sick (an unknown disease they believe is due to witchcraft) and Doña Tiburcia does most of the agricultural work, including that in the fields. She also brings the income home from her work as a (lay) chiropractor.

Homegarden
All of the plants in this space have been cultivated and cared for by Doña Tiburcia, who is recognised in the village for her knowledge about plants since she is a healer. She has been growing Xmejenal, 'Nal-tel' (maize) and 'Tzol' (squash) in this space since they were granted with the land to build their house, about 47 years ago. Maize plants are planted in an area that is quite visible to the outside world, where people passing by can admire the plants. Don Crisanto neither now nor when he was healthy has been involved in tasks in the homegarden other than construction.

Agricultural fields
This family has only one agricultural field where they are growing Xnuk nal ('Sac nal' and 'Can nal'; white and yellow) intercropped with squash 'Xnuk kuum'. The woman has done most of the work in this space, including sowing, due to the severe illness of her husband. However, she takes his opinion into consideration and physically takes him to the fields every day. She rides a tricycle with a wagon and carries him a distance of about 1.5 kilometers. This is because, even when she does most of the work, a man always needs to be in the field with a woman. It is not considered proper if a woman goes by herself.

Varieties they would like to have

They both said that they would like to have Xnuk nal 'Xhe ub' purple. They lost the seed about eight years ago and if they could get it, they would like to grow it in the fields. As to squash, Doña Tiburcia said she would like to grow 'Xtop' because of the seed, and that she would grow it either in the homegarden or in the field. The seed was also lost at about the same time, due to excessive rains.

5.1.4 Family 4 (Gamboa-Noh)

> I just bring the seed, the women decide how to prepare it [Don Fausto, talking about squash]'.

In one single sentence, Don Fausto gives strong evidence about the predominance of women's criteria and decision making in post-harvest management and the extent to which he trusts such knowledge. Women's decision making is clearly evident.

This is the only extended family in the research sample and perhaps one of the few in the community. The three families have their own dwellings in the same terrain, but share tasks and labour. It is headed by Don Fausto and the other two household heads are his sons. It is also one of the two families in the research sample where the gender division of labour seems to be more emphasized.

Homegarden
Around each of the three dwellings can be found home garden plots that belong to each of the adult women, all of which contain squash 'Xnuk kuum' near to the house. A few maize plants were only found around the elderly couple's dwelling, which belong to Don Fausto, the head of the household. He sewed it with some help from his eight year-old grandson. The three adult women in this household did not manifest any interest in these maize plants. Indeed, care of these plants was provided by Don Fausto himself and his grandson who is the age where he is learning to grow maize. Therefore, in this case, growing maize in the homegarden might not involve negotiation between men and women; however, it is serving as an educational or knowledge transfer site for maize cultivation.

Agricultural fields
This family has five agricultural fields, one registered by Don Fausto, the head of this extended household, and the rest registered by his two sons (two fields per son), where each of them is the main worker of the land under his name. The product from the different fields is brought home altogether, and the women divide the processing and food preparation tasks among themselves. For maize, women do not seem to make any open requests for varietal selection as all of the cultivars grown are landraces and therefore all are good for *tortillas* and other common forms of use. In other words, they are satisfied with the maize harvest that the men bring home since all of it is of first quality. Regarding squash, the only cultivar grown is 'Xnuk kuum', found intercropped with most of the maize in different sections of each of the five agricultural fields. Men grow it because of the increase in maize performance that intercropping provides, in spite of the fact that, according to Don Fausto, it is difficult to keep squash plants as they die when herbicides are applied. However, squash is a necessary ingredient in the family's diet and women are quite knowledgeable about the versatility of uses of this particular cultivar.

Varieties they would like to have
Although Don Fausto has all the varieties he would like to have, he is willing to try any seed given to him, preferably in his fields as there is more space. As to squash, if he could he would like to also grow 'Xtop' as the seed can be used in many forms and can be sold for a good price. On the other hand, women in this family said they that all of the maize that their men bring home is a blessing. None of them mentioned a variety they would like to have.

5.1.5 Family 5 (Cob-Sansores)

> *"*My wife is very skilful in all that has to do with the homegarden. She can sow and take good care of any plant…When she was healthy, this homegarden used to be full of plants, but now that she is sick, she can only do a little bit".

In his testimony, Don Delfino clearly and openly recognises the skills and knowledge of his wife in plant management. Moreover, it is even acknowledged by him that he is not as skilful as is she. This is shown by the fact that, now that she is unable to carry out extensive homegarden work, this productive space no longer yields as it used to even though Don Delfino works in it, as is seen below.

This household consists of an elderly coupled whose younger son stays with them only seasonally. Most of the agricultural work – in the homegarden and in fields - is currently done mainly by Don Delfino, the male head of household, since Doña Liberata has been very sick during the last months.

Homegarden
'Nal tel' is being grown for the first time after several years. The seed was given to them by a relative. Don Delfino has been sowing and caring for this maize although he recognises that his wife is a great curator, having much knowledge regarding plants management and use, since she is also a healer. In other times, she used to sew some maize in the homegarden but now she only does the degraining and food processing. Squash 'Xnuk kuum' was also found in this space but it was said to have grown by itself. They both like to keep it, and therefore take good care of the plants. This homegarden, rather than being the scene of male-female negotiation regarding varietal selection, makes evident the recognition that men and women have about each other's plant management knowledge and skills. He recognises her abilities whereas now that she is no longer able to work as before, he can freely make decisions and work in 'her' production space.

Agricultural field
This family has only one agricultural field where they are growing Xnuk nal ('Sac nal', 'Can nal' -white, yellow-) intercropped with 'Xnuk kuum'. Most of the labour input is provided by the male head of household who is occasionally helped by his youngest son when he is in town. Although he has been offered some improved seed, he decided not to grow it. According to him it is too much work, it needs water and one never knows if will yield a good harvest. Furthermore, Doña Liberata does not like it; she prefers the *payis* maize, which is easier to degrain and gives a softer dough. Therefore, her preferences are evident with regard to what is grown in the field, suggesting the degree of influence she has over Don Delfino's decisions.

Varieties they would like to have
Don Delfino says that he would like to have 'Nal Xoy' to grow in the fields, since he has heard it is as yellow as Xnuk nal 'Can nal' but is higher yielding. Doña Liberata said that she is very happy with the 'Nal Tel' grown this year in her homegarden by her husband, and no more maize varieties are needed. Such differing criteria might be related to the gender division of labour: 'Nal Xoy' is known to be valued for its agroecological performance while 'Nal Tel' is very valued for its aesthetics, processing and organoleptic characteristics as well as for its scarcity and local market value. Regarding squash, they both said that they would like to have 'Xmejen kuum' because is very nice to eat while immature, suggesting once again the importance of forms of consumption for selection. She also mentioned that she would like to have 'Tzol' which is even more delicious than 'Xmejen kuum'. She would be happy to grow these squash cultivars in the homegarden if seed were available, which supports the female gender affiliation for these two squash cultivars.

5.1.6 Family 6 (Tello-Tec)

> 'Teachers from the school come and ask me to keep on preparing food for them. All ingredients used are mainly grown in the homegarden or the plots… With the money I get, we have constructed a new room here and a small house on the terrain in front…. In that homegarden, I also grow 'Xmejen kuum' and other plants and trees I like very much…. Other women often tell me that my homegardens are very beautiful… I actually worry about the woman my son will choose to marry…. I hope it is somebody who will take good care of that homegarden'. (Doña Elide)

The homegarden for this woman represents a substantial source of income not only for herself but for her family. Moreover, she is recognized in her community as a good cook and plant manager. Implicit is the feminine transfer of knowledge for plant management and care of homegardens. She maintains two homegardens, one by her house and another in a house that the couple has built for one of his sons when he gets married. For instance, Doña Elide is quite concerned about the woman her son will marry and who will manage and maintain the homegarden that she 'inherits'.

Don Florencio and Doña Elide are a middle age couple accompanied by his youngest son. This household is characterised by the woman's entrepreneurship. She seems to freely implement her decisions about what cultivars to grow. She is indeed very concerned about growing cultivars and selling food items that she makes from them to teachers in the primary school near her home.

Homegardens
The homegarden in the house they inhabit hosts a huge diversity of plants; not even Doña Elide knows the number of species she has there. A small plot of Xmejenal was found in this homegarden. Also, in it she carefully tends 'Xmejen kuum', 'Xtop', and 'Tzol' squash. The homegarden is exclusively the domain of Doña Elide; she has decided about every single plant that is grown there. Don Florencio's only task in the homegardens consists of feeding the pigs and, picking fruit from the fruit trees. The son only helps Doña Elide with the tasks that she asks him to do, asks for, such as weeding. Doña Elide is very proud of this and the other homegarden. Moreover, some other women in the village admire her homegardens. Therefore, for this woman, this space not only represents a potential source of income and recognition by her husband, son and other people, but it is a also way for her to be proud of herself as a woman.[29]

Community plots
This family has two community plots, one resembling the cropping pattern of a homegarden and the other resembling that of a small agricultural field. In both of them they grow Xmejen nal maize (white, yellow, red). In one of them, that nearest the house, there is an area with 'Xmejen kuum' and another with 'Xtop' squash cultivars, both planted separately from the maize plants, as it is usually the pattern in homegardens. In the other plot, 'Xnuk kuum' squash was found intercropped with maize. Doña Elide goes to these plots whenever she desires, nevertheless, she shows a greater sense of belonging in the community plot that suggests a homegarden pattern. In that plot, she grows the squash whereas in the other it is her husband that grows it. This provides further evidence of the gender differences in cropping and selection patterns.

Agricultural fields

[29]A point that deserves further attention is that of recognition among women. In spite of the fact that maintaining a large diversity of cultivars was not found to lead to status and recognition in such a commoditized village, having a homegarden rich in biodiversity or with valued and/or scarce cultivars (such as those growing 'Tzol' squash), is does confer status among women.

This family has a relatively large amount of land area in agricultural fields (four hectares) which is all sewn with Xnuk nal 'Can nal' (yellow maize) intercropped with 'Xnuk kuum' squash. All tasks are done by Don Florencio and often by his son. Doña Elide never goes to the fields since she has no time. However, she is very insistent on having 'good quality' maize from the fields. When degraining at any time of the year, she separates out the biggest and strongest grain kernels that are not pitted from the yellow Xnuk nal. She therefore expects to harvest good maize ears. Therefore, in spite of not physically participating in field labour, Doña Elide not only influences varietal selection but encourages the men to achieve the highest quality product.

Varieties they would like to have
Both Don Florencio and Doña Elide said that they would like to have 'Nal tel'. They lost the seed some years ago. If they could have the seed, they would grow it in the community plots. Doña Elide said that she would like to have Italian squash (a non-landrace). She said she has seen it in other places but never in this town. If she could grow it, she would do so either in the homegardens or in the community plots. This not only reveals the influence and decision making that she exercises regarding varietal selection but also gives illustrates her entrepreneurial spirit.

5.1.7 Family 7 (Tec-Pacab)

> 'I kept separately both 'Xnuk kuum' and 'Xmejen kuum' seed for sewing …I wrote the name of each one on a small paper left within the stored seed…but Don Fernando did not notice and, when he came to pick up the 'Xnuk kuum' seed to sow in the field, he took the 'Xmejen kuum' instead! So, this year we got some *mecates* of 'Xmejen kuum'…not bad! After that, I started to leave some 'Xmejen kuum' fruit to become mature enough in order to have new seed and sow it in the homegarden (Doña Juanita).

With her testimony, Doña Juanita makes her knowledge regarding squash varietal distinctions and selection evident, as well as her potential for decision making regarding varietal selection for agricultural fields. Her decision making regarding squash varietal selection for the homegarden is evident as well.

Don Fernando and Doña Juanita are a middle age couple with their two youngest children living at home. This is one the families with high social status in the community, perhaps because of the involvement of both the man and the woman in community service. Doña Juanita is also one of the few farm-women holding a high school degree in the village.

Homegarden
Don Fernando has grown part of the new improved seed that he obtained from local affiliates of one political party this year in the homegarden at the request of Doña Juanita. She wanted to have some maize in the homegarden because it is easier to have some maize available nearby. Indeed, all three field crops are present in this homegarden (bean, squash and maize). Both Don Fernando and Doña Juanita take care of these plants. The squash found in this space is 'Xmejen kuum', which Doña Juanita has continuously grown since they found it for the first time in the terrain when they build their house, about 26 years ago. In this homegarden, varietal selection of maize, squash and beans (the *milpa* triad) seem to be the outcome of explicit negotiations between the man and the woman. She makes her requests clear and he makes the decision about where and when to grow it, and grow it he does indeed.

Community plot
At the beginning this year Don Fernando had sown only Xnuk nal 'Can nal' in this space. Because of a lack of rain, he then needed to re-sow most of the area about three times. The last time he sewed improved maize ('VS 536'), which now predominates, and some Xnuk nal.

Both are intercropped with 'Xnuk kuum' squash. Only Don Fernando provides labour inputs in this space; Doña Juanita never goes but she is aware of the quality of the harvested maize. She does some of the storage at home and most of the degraining. Therefore, she also selects seed that can be used to sow for the next cycle. In this case, although she may not have suggested what to grow in this space, she physically influenced the outcome through her seed selection practices.

Agricultural fields
This family has two agricultural fields, one larger than the other. In the larger one, Xnuk nal 'Can nal' is grown, while in the smaller one, Don Fernando has planted improved 'VS-536' maize. As in the community plot, most of the labour input is provided by Don Fernando but, once the maize is brought home, Doña Juanita does some storage and seed selection for future crops. As in the case of squash seed, Doña Juanita is very organised. She writes the name of the stored cultivar with the intention of avoiding mixing seed from different maize cultivars. In the case of squash, this strategy did not work. Don Fernando was confused with the 'Xnuk kuum' and 'Xmejen kuum' seeds. Similar to what occurs in the community plots, although Doña Juanita may not have suggested what to grow in this space, she physically influenced the outcome through seed selection .

Varieties they would like to have
Don Fernando said that he would like to have to grow in the fields a yellow improved maize he had some years ago, or 'Nal Xoy' because of the high yield and size of ears, or Xmejen nal because of its short maturation cycle. Doña Juanita said that she will be happy with any high yielding maize and that it would be good to grow it in her husband's fields or in the community plot. As she knows beforehand that she is not dealing with the production of such cultivars, she would like to have something that fulfils her husband's criteria. As to squash, Don Fernando said he would like to grow 'Xtop' in his fields again whereas Doña Juanita said that, if it were available, she would like to grow 'Tzol' in her homegarden, which can be taken as further evidence of the gender affiliation of this squash cultivar.

5.1.8 Family 8 (Cox-Adrian)

> 'All of the seed we have was given to my husband by his grandfather… My husband likes to grow a lot of 'Dzit bacal' because not many people here nowadays have as much as us….but I actually don't like it very much. The cob is so thin that it easily breaks and degraining becomes harder. So, I always ask him to also grow plenty of 'Xnuk nal' for our use…he tries every year to grow a whole field with Xnuk nal'. (Doña Candita)

Candita gave an illustration of how landrace' seed is a valued family asset which is transferred mainly through the male lineage. In spite of the fact that there appears to be a slight difference about the varieties she and her husband like, Andres accepts Canditas' preference for Xnuk nal, indicating that she has indeed influence over what is grown in what amount in the fields.

Andres and Candita are one of the youngest couples in the research sample with school-age children. Andres works full-time both in his and other people's fields. Candita is in charge of all daily household tasks. She also hires out as a maid to someone in town. She says that she keeps the money she earns with her because otherwise Andres may spend it on alcohol.

Homegarden
In this space, Andres has explicit decision making power over varietal selection, but he nevertheless recognises and trusts the labour and skills of his wife while educating his sons for maize growing. Moreover, at least one maize cultivar in this space represents a potential source of income, over which Candita has the chance to have control. Andres has sown 'Dzit

bacal', Xnuk nal 'Xhe ub', and the improved 'VS-536' in this space, the first two intercropped with 'Xnuk kuum' squash. Care of the maize planted in this space is done by Candita and the children. She did not ask him to grow maize there, but this is more like a custom they have had since they were married. She likes the fact that people know that they have Xnuk nal 'Xhe ub' in the homegarden, and when it is mature enough, people stop by wanting to purchase it. They can make some money this way. When people stop to buy and Andres is not there, Candita sells it and keeps the money herself, which is mainly destined to pay the children's school expenses.

Agricultural fields
The two fields pertaining to this family are relatively small (25 and 15 *mecates* respectively - one and 0.6 ha respectively), where all of the labour input is provided by Andres. One of the fields is sewn with Xnuk nal ('Can nal', 'Xhe ub' and 'Xgranada') and the other with 'Dzit bacal'. In both cases, maize plants are incropped with 'Xnuk kuum' squash. Andres is very proud of being one of the few people in town who has a whole field sewn with 'Dzit bacal', an exotic landrace with an extremely thin cob which is very valued for local-crosses as it may produce ears with more grain weight than cob. However, Candita prefers to have more Xnuk nal for home consumption due to the processing and consumption characteristics of this landrace; Andres appears to respect her wishes, which confirms the influence she has over varietal selection in Andres' fields.

Varieties they would like to have
Andres said that he wants to try out any improved variety and now he has one, which was just recently sown in the homegarden. Candita said it would be nice to have some white maize with a thin cob but as not as breakable, which her husband would be likely to try in the fields. As in the case of Family 7, this suggests shared criteria. Candita would like to have something that fulfils her husband's criteria, presumably because she is not dealing with the production of such cultivars. As to squash, Andres said that he would like to have some 'Xtop' in the field, because when they want some of the seed they always need to buy it or exchange with somebody else. Candita said that she would like to have some 'Xmejen kuum' in the homegarden so she would not need to buy it, as she often does. This case as well supports the gender affiliation of this squash cultivar. If she wants to have it, she needs to grow it in her production space.

5.2 Conclusions

Across each of the families selected for the case studies presented above, there is evidence of complementarity between men and women for maize and squash varietal selection. That is, men and women are not separate decision making entities regarding what to grow in what amounts in a given space - rather the interests of both are considered and reflected in both respects. Nevertheless, this complementarity is more noticeable in agricultural fields than in homegardens. In agricultural fields, substantial amounts are grown and, therefore, most of the consumption needs must be met for several months. Complementarity appears to be strongest for maize and the squash grown in fields, but not for the squash cultivars only found in homegardens ('Xmejen kuum' and 'Tzol'). For both crops, varietal selection is influenced by the gender division of labour. For example, since women are in charge of most of the processing and food preparation processes (see chapter 4), the qualities of a given cultivar in such stages determine to a great extent her selection criteria.

Regarding cultivars grown in men's agricultural fields – except for the case of Doña Tiburcia (F3) who sows the cultivars in the field herself - women explicitly request their husbands to grow certain cultivars in certain amounts. Although men may have their own preferences, they take women's requests into consideration while it seems that they also agree with the reasons that women give for these requests. This suggests that men recognize women's labour, knowledge and skills, in the case of maize and squash grown in fields at least

regarding some post-harvest steps (i.e. processing and food preparation), while for the squash found in homegardens such recognition covers the whole production-consumption chain.

Regarding cultivars grown in homegardens, decision making differs between the two crops under investigation. For maize, in the cases described in this chapter either the man and the woman or the man alone decided to grow maize in the homegarden while taking into consideration the availability of female labour for plant care. For squash, decision making about growing or maintaining a cultivar in the homegarden depended on women. These findings suggest a difference in decision making for varietal selection not only according to production spaces but also by crop.

Decision making is a prerogative exercised by both men and women where both have a certain degree of influence over the other as a result of the knowledge and skills that each holds and the trust and recognition of the counterpart. For instance, in the case of maize in agricultural fields, men may have the final decision about what cultivars to grow in what amounts, but women have the power to influence men's decisions through their own decisions since they are in charge of processing, food preparation and most decisions about final forms of consumption. Such influence was seen in all of the cases presented above, which suggests that there is a perception of complementarity between the sexes in varietal selection is a norm present in spite of possible differences relating to age, livelihood, and other social, economic and cultural factors.

6 CONCLUSIONS

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6.1 Conclusions

The research presented in this thesis focused on the influence of women and gender relations in the selection of maize (Zea mays) and squash (Cucurbita spp.) cultivars in 'traditional' production spaces (men's agricultural fields – *milpas* - and women's homegardens - *solares*), and also in a 'new' production space (community plots) that was discovered during fieldwork in a relatively commoditized village in the maize belt region of Yucatán State, México. The global hypothesis of this study was that varietal selection is influenced by agroecological and environmental factors, access to inputs (i.e. seed, labour force availability), and social, economic and cultural factors that are gendered. Conclusions are presented according to specific objectives and their corresponding hypotheses.

6.1.1 Conclusions by research objectives and hypotheses

The first specific objective of the research was to explore how different steps in the production-consumption chain and final forms of uses of maize and squash cultivars may influence the men and women's decision making and preferences regarding varieties, and how is this influenced by the gender division of labour in this chain. The corresponding hypotheses were that (a) final forms of use in the domestic sphere and in markets influence both men's and women's decision making and preferences in the production-consumption chain for varietal selection; and (b) access to inputs and agroecological and environmental factors influence post harvest management (storage, processing and food preparation) and varietal selection criteria.

Findings presented especially in Chapter 4 have demonstrated that different steps in the production-consumption chains and final forms of use of the cultivars under study influence both men's and women's decision making with regard to varietal selection. There are different patterns in the gender division of labour and final forms of consumption between the two crops that influence men's and women's varietal selection criteria. For maize, men have more selection criteria for production performance and storage while women have more criteria related to processing and food preparation, where final forms of consumption are also considered. Such criteria generally correspond to the gender division of labour, responsibilities and knowledge in the production-consumption chains, and are as well influenced by access to inputs and agroecological and environmental factors. For instance, men may prefer the local cross 'Nal Xoy' over the improved populations due to resistance to drought and high yields, while women may prefer the landrace Xnuk nal yellow over 'Nal Xoy' as the former has the advantage over the latter of being easier to degrain by hand and faster cooking (which presents advantages related to labour and fuelwood availability, respectively) and softer dough (presenting an advantage for shaping *tortillas* by hand since machines are not used). Moreover, women may prefer Xnuk nal white over Xnuk nal yellow since the former – which otherwise has the same processing characteristics - makes a tortilla with better texture, taste and aesthetics. For squash, men have selection criteria only for those cultivars that are traditionally produced in agricultural fields while women have definite selection criteria for all four squash varieties. Men's criteria for 'Xnuk kuum and 'Xtop' are mainly determined by the agroecological advantages that the plants represent for maize intercropping and by the high market price of the seed in the region since it is a main ingredient in Yucatec cuisine. On the other hand, women's selection criteria for these two squash are predominated by final forms of consumption. For instance, about 20 regional dishes require either of these two squash as a main ingredient (Cazares and

Duch forthcoming) where 'Xnuk kuum', the most cultivated squash in the area has a greater number of uses and dishes of any of the other varieties. Of these uses, most employ the seeds, which are highly resistant to humidity and warm temperatures and can be safely stored for months and some even for years once processed (sun-dried and/or grounded). Regarding women's selection criteria for the two varieties that they grow either entirely on their own ('Tzol') or mainly on their own ('Xmejen kuum)', these two varieties are considered as of better taste and texture than 'Xnuk kuum' and 'Xtop' for forms of consumption involving immature fruit (i.e. in soups), with still a higher ranking for 'Tzol' over 'Xmejen kuum'. Indeed, as the seed of these two varieties is not as abundant and resistant as in the other two varieties and the fruits are more delicate (perishability is high due mainly to humidity and warm temperatures), 'Tzol' and 'Xmejen kuum' fruit are consumed nearly exclusively when immature.

The second objective was to understand the whether and how the production spaces under study have an interactive relationship in relation to varietal selection. The corresponding hypothesis was that there is a relationship between men's and women's production spaces with respect to the production of the varieties under study. It was shown in Chapter 3 that agricultural fields, homegardens and community plots have an interactive relationship in relation to varietal selection. For maize, there are differences in cropping patterns and in amounts produced, where those in homegardens and community plots are relatively small compared to those produced in agricultural fields. However, some households maintain different maize cultivars in homegardens and community plots since the latter two are experimental sites where new varieties are tested and compared, and are also used as genetic reservoirs, to conserve the genetic purity and homogeneity of cultivars. For squash, homegardens and community plots serve as sites of conservation mainly through the continuous cultivation of varieties that are otherwise difficult to take care of in agricultural fields mainly due to the delicate management that they require (continuous weed removal, water, care against predator attack). Except for two squash varieties ('Tzol' and 'Xmejen kuum'), homegardens, community plots and agricultural fields may often contain the same cultivars. However, the reasons for cultivating a given cultivar in a given production space are related not only to the degree of gender affiliation of the spaces - and the implicit access and control that either men or women may with respect to the product - but are as well related to livelihood strategies developed by both men and women. For example, cultivating a cultivar of high market value in the homegarden may mean some cash in the pocket for women while growing any other cultivar near the household may facilitate women's access to food while reducing their dependency on men who must normally bring the food in from the fields, particularly for that which is grown on a daily basis. As well, the interaction between male and female production spaces is shows that, in spite of the fact that men may have more access to and control over maize since the largest amounts are produced in fields, and although the highest diversity of squash is found in homegardens, contrary to what has been frequently found in Africa and Asia (i.e. Sillitoe 2003, Ntumgia 1998; Sperling and Berkowitz; Ferguson and Mkandawire 1993)), maize is not a predominately 'male' crop nor is squash a 'female' crop, as will be seen below.

The third objective was to identify the degree of influence that women have over varietal selection decision making in agricultural fields as men's spaces and in homegardens as their own spaces and *vice versa*, the influence that men have in homegardens as women's spaces and in agricultural fields as their own spaces. The corresponding hypotheses were: (a) that women and men are not separate entities in the decision making processes about what cultivars to grow and in the production-consumption chain,

however, they have different preferences and interests regarding which varieties to select and cultivate; and (b) that women have an influence on varietal selection decision making in agricultural fields as men's spaces, and in homegardens as their own spaces, and *vice versa*.

The influences of each sex were indeed present, as hypothesized. Women's influence was exerted principally in three ways: by selecting seed at time of processing, by making requesting men to plant specific varieties and/or specific quantities, and by cultivating and taking care of plants on their own. The first two modalities predominated in maize for all production spaces while the third predominated for squash in homegardens and community plots, but not in agricultural fields. Men's influence was exerted through seed selection both in agricultural fields and during processing, by growing and taking care of plants on their own in agricultural fields, and by sowing cultivars in homegardens that women then care for. Men primarily make the decisions to plant maize where women influence these decisions, and also make decisions to plant squash in agricultural fields, also with women's influence, where men are more concerned with the agroecological functions of squash for maize intercropping and, to a lesser extent, with the market value of squash seed. Women primarily make the decisions to plant squash varieties in homegardens, without male influence. Regarding the other hypothesis, that women and men have different preferences and interests regarding which varieties to select and cultivate, this is examined further below together with another hypothesis that asserts the importance of the domestic sphere in varietal selection.

6.1.2 Agroecology and the production-consumption chain

It was hypothesized that, since most of the product in the community under study is for own consumption, many of the criteria for varietal selection are established within the domestic sphere.[30] It is certain that agroecological factors such as rainfall, soil type, water availability, disease and pest resistance and yield have a strong influence on varietal selection (Tuxill and Chávez-Servia 2002; Duch 1988; Hernandez X., 1995). Previous research in the village under study has demonstrated that, for maize, such factors give rise to genetic diversity as reflected in maturation cycles and yields as well as in morphological characteristics of plants, such as in the tassel, ears and grains (Camacho 2002; Burgos *et al.* 2002). However, the post-harvest domestic sphere may have even greater influence in terms of numbers and types of varieties that are maintained, since most of the production is destined toward own consumption. As women tend to predominate in post-harvest management (except for maize storage in fields) while men predominate in production and storage in fields, men and women often have different criteria for varietal selection. Findings have also shown that, in maize, landraces in general are preferred over other maize types mainly due to the forms of final consumption, while in squash, each cultivar appears to be selected due to specific forms of use (all four are landraces).

Regarding maize production, both landraces and the local cross seem to be preferred over improved populations due to higher yields (Chávez-Servia *et. al* forthcoming). Men

[30]It is already known that both agroecological context and market orientation influence selection criteria. However, the remaining the criteria, determined within the domestic sphere, have barely been explored in the Mexican context. The research here presented therefore emphasized this sphere.

seem to have more responsibility during the initial stages (production and storage) while women have nearly exclusively responsibility for the intermediate steps (processing and food preparation). In storage, women's criteria seem to exist at the moment that maize enters the physical space of the household since, from this moment women's criteria predominate in the post-harvest chain. Landraces of long maturity cycle and the local cross seem to be more resistant than landraces of short maturity cycle and improved populations. For processing and food preparation (towards a form of final consumption), landraces are by far preferred over the local cross and improved populations.

As chapters 3 and 4 together have shown, post-harvest steps and final forms of use have definite associated criteria that appear to be reflected in the selection and maintenance of varietal diversity in the village, apparently at least as much, if nor more, than as agronomic conditions or steps in crop production alone. For example, in the case of Xnuk nal (Table 6.1), the most cultivated maize landrace by land area, there seems to be a marked difference between the white and yellow expressions where women's rankings seem to be influenced by the quality of *tortilla* which is the main form of daily consumption. The case of Xnuk nal purple or 'Xhe ub', is very special since it seems that this maize cultivar is the only one with exclusive forms of use. Such differences in intra-specific genetic variability are relevant for plant breeders and conservationists, since, as has been shown thorough this report, differences in processing and food preparation characteristics or in final forms of use are determinant factors for selection criteria.

As examples, tables 6.1 and 6.2 report on the total set of selection criteria discovered for two of the most cultivated maize and squash varieties in the study area.

Table 6.1 Selection criteria for the two most frequently cultivated maize varieties by land area

Selection criteria	Xnuk nal white	Sex of informant	Xnuk nal yellow	Sex of informant
Agroecological & production criteria				
Plants are strong	X	M		
Drought resistant	X	M		
Grains do not get pitted			X	M
Higher yield than other landraces and improved varieties	X	Field measures*	X	Field measures*
Post-harvest management, final forms of use and cultural values				
Seed has been with them for a lifetime (inherited)	X	M		
It is the best for tortillas	X	MF		
Can be sold for a good price	X	F		
Dough consistency	X	F		
Does not become 'soupy	X	F	X	F
Has a very nice taste			X	MF
Can be safely stored in granaries in the field	X	M	X	M
Grains are more crystaline, then heavier and pitt resistant			X	M
Grains are more 'floury', thus, tortillas are softer	X	M		
Easy and fast degraining	X	F	X	F
Fast cooking time	X	F		
Grain milling	X	F		
Easy to shape into tortillas	X	F	X	F

Aesthetic appearance of some common dishes	X	F
Ethnic identity	X	M
Ceremonial use: sacred beverage preparation	X	F

* Graefe et. al. 2001; Chavez-Servia et al. forthcoming.

Data in Table 6.1 show not only that there are more criteria related to post-harvest management and final forms of use in comparison to agroecological and production factors and that, in spite of the gender division of labour and related differences knowledge, men and women do share several criteria that are related to women's work, therefore supporting the hypothesis that men do recognize women's criteria and therefore are likely to respond positively to women's requests for cultivation, indicating that their selection criteria, roles and knowledge are *complementary*.

Table 6.2 Selection criteria for the two most frequently cultivated squash varieties by land area

Selection criteria	Xnuk kuum	Sex of informant	Xtop	Sex of informant
Agroecological & production criteria				
Soil moisturizing for maize cultivation	X	M	X	M
Fruit yielding	X	M		
Seed yielding	X	M	X	M
Post-harvest management, final forms and use and cultural values				
To sell the seed	X	MF	X	MF
Versatility of uses -by part of the plant	X	F		
Specific food forms (dishes)	X	MF	X	MF
Seed taste	X	MF	X	MF
Seed safely stored in fruit	X	MF	X	MF
Faster seed sun drying	X	F		
Seed toasting	X	F	X	F
Seed grounding	X	F	X	F
To eat fried	X	F	X	F
To cook stuffed	X	F		
In beverage			X	F
In hard candy	X	F		
Animal feeding	X	F		
To eat as snack w/ salt and chile	X	F	X	F
To cook *'papadzules'*			X	F
To cook *'pipian'*	X	F		
As topping (dishes and beverages)	X	F		
Ceremonial uses	X	MF	X	M

Table 6.2 above summarizes the criteria presented in chapters 3 and 4 for the squash varieties most frequently cultivated by land extension. Regarding production related characteristics, in spite of the fact that yields and maturation data (field measurements by Canul et al. 2000; Canul et al. 2002) are only available for two cultivars out of four, numbers show that both 'Xnuk kuum' and 'Xtop' may yield relatively similar amounts of seed in spite of the difference in fruit yields. However, 'Xnuk kuum' is by far more frequently cultivated than 'Xtop'. This may be partially related to the fact that 'Xnuk kuum' has a higher versatility of uses (final forms of consumption) than 'Xtop'. Men seem to have more knowledge about the soil moisture qualities of the squash cultivars that they are usually in contact with, while women have more knowledge regarding the plant management

requirements of each cultivar. In post-harvest management (storage, processing, food preparation and final forms of consumption) women's criteria predominate by far over men's criteria where it is evident that women hold a vast knowledge among the cultivars regarding plant management and specific culinary characteristic and qualities. For instance, squash cultivars - in contrast to maize cultivars - seem to be cultivated with specific uses in mind since each variety has specific traits that make of it the best suitable squash for a given form of use. Selection criteria for the squash that are frequently found in all three types of production spaces have also highlighted the importance of post-harvest steps and final forms use as determining factors, apparently at least as much, if not more than, agroecological factors in crop production alone. As is the case in the study village in Yucatan, the importance of the domestic sphere as a realm of crop diversity promotion and conservation is indeed supported by extensive studies made in other areas of the world, as discussed in Chapter 1.

According to the above, and in relation to the last objective in this research which was to understand how varietal selection is at least partially influenced by gender relations and gendered norms. These are in turn manifest in the gendered division of labour where the predominance of either men or women in a given space and in the production-consumption chain seems to be dynamic both in time and in space. For example, in maize, men predominate in production and storage in agricultural fields, but once the product enters the house, it is the women who exercise most decision making about the form of use and destination sphere. Moreover, the gendered division of labour is in turn a reflection of the gendered norms as set by social, cultural, economic constructs and cosmology which are all imbedded in both men's and women's behaviour and concepts about what is 'correct' and 'no correct' and, therefore, are uncontested. For instance, the 'traditional' production spaces (homegardens and agricultural fields) show highlighted gender boundaries. Men have assigned 'male tasks' in the homegarden such as cattle feeding while women may never enter an agricultural field on her own. Such boundaries are however unbounded in a 'new' production space, the community plots.

6.1.3 Gender bias: three errors in research around maize and squash varietal selection in Mexico

Howard pointed out the errors that result from the gender bias present in much ethnobotanical research: omission, unreliability and interpretation, where gender bias further affects "the theories, the questions formulated, the methods used and the research outcomes" (2003:19). The work presented here has provided evidence that gender bias is present in the research carried out to date on the population and crops under study, which is also very likely to be the case for most of the rest of the Mexican research on maize.

- Omission is 'the failure to research women's knowledge and use of plants…the species and varieties that only women know are omitted, and thus biological diversity is underestimated'' (Howard Ibid). In addition, the research reported here shows that reference can also be made to the omission of 'women's spaces'. In the previous crop-diversity research in the Yucatan, homegardens were omitted, so that biological diversity was under-estimated: one variety of squash, 'Tzol', which is found only in homegardens in the community under study, was not identified as part of the Cucurbit spp. diversity, and therefore this diversity was underestimated (in the case of squash, by 25%!).

- Unreliability refers to using ‘’sources that are not well informed, which leads to the improper identification of plants, their management, characteristics, uses and names’’ (Ibid). It has been assumed that men are the most informed sources regarding varietal selection, and that women either do not have relevant knowledge or their knowledge is not nearly as relevant as men’s; it has also never been assumed that women have influence on varietal selection in agricultural fields. Therefore, steps in the production-consumption chain such as processing and food preparation – which rely on women’s knowledge and skills - have been generally overlooked when researching farmers’ selection criteria, and therefore the results are unreliable since they emphasize only one set of factors that are involved in selection and hence they cannot be aware of the reasons for maintaining specific varieties and rejecting others, particularly in cases where several varieties have similar agroecological characteristics (i.e. Zimmerer 1991 as referred by Howard 2003).

- (Mis-)interpretation refers to ‘’a misunderstanding of people-plant relations since a critical component – gender relations - is not revealed…” The overwhelming emphasis in farmers’ varietal diversity research in the area and in Mexico in general has been on agroecological (genotype x environment) interactions and on the physical act of selecting a number of individuals (parents seed) that will be used to generate a new supply of seeds (offspring) in the next crop cycle. The influence of women and gender relations, as well as the domestic sphere (including post-harvest knowledge, environments and preferences), as well as culture, have been excluded. The socio-cultural context of crop varietal diversity has thus been largely omitted.

Howard further argues that:

> The repercussions [of such gender bias] go far beyond the creation of biased scientific knowledge: they extend into related practices, policies and interventions that are intended to change the interactions between people, and between people and their environments. They can distort the outcomes in ways that are unanticipated and often undesirable (Ibid.)

The main implications of the above errors for the ‘related practices, policies and interventions…’ in the Yucatec and Mexican context are that: (1) for formal plant breeders, breeding of new cultivars on the basis of only agroecological and/or men’s criteria will to a certain degree contribute to acculturation processes since the kitchen, the domestic sphere, and production spaces other than the fields, which are all domains that maintain and transmit culture and traditions, - are all overlooked. Varietal improvements may not fit with the traditions, values and technologies and hence either create rejection on the part of the users or force them to change practices; (2) for genetists conservationists, the failure to identify specific characteristics for post-harvest management and final forms of use in the production-consumption chain for each cultivar stored, either preserved in the gene banks or *in situ*, may lead to inappropriate use and assessment of the preserved diversity, and therefore, overlooking the full benefits for further breeding according to the potentials of a given cultivar; (3) for *in situ* conservationists, in addition to the previously-mentioned point, the interaction among gendered productive spaces and related gendered knowledge, skills and selection criteria, need to seen as a priority when researching diversity ‘in the places where it has originated and/or evolved’ as means to provide a full benefit to those who use, maintain and benefit the most from biodiversity, as one of the objectives of the Convention on Biological Diversity. Finally, a holistic assessment of cultivated diversity from production

to final forms of consumption and sphere of destination will contribute not only to an increased improved recognition of women as gatekeepers of crop diversity, but also the farming family as a whole is likely to benefit from the increased efforts of interventionists, policy makers and practitioners. This is because, as guardians of diversity of both sexes, who hold specific knowledge and skills and may complement each other's labour and selection criteria, are recognized as equal, and therefore conservation efforts are able to appropriately target those who have preserved it for generations.

6.2 Needs for further research[31]

Farmer varietal selection research, even that which is gender sensitive, has largely failed to consider cultural constructs of nature, cognition or gender. An underconceptualised element of particular practices of environmental action and related social ideologies is gender relations, especially how cultural and material constructions of gender are reflected in mosaics of gendered knowledge, spaces, and environmental practices (MacCormack & Strathern 1980; Howard 2003), but where the gendered nature of cultural perceptions of ecological interactions for ethnotaxonomy and cultivar selection have rarely been theorized (eg Nabhan 2001; Sillitoe 2003).

Further research needs to focus on the *cultural constructions of gender and nature* that underpin the divisions and complementarities of roles, responsibilities, knowledge, and spaces between men and women in specific contexts. Concepts of masculinity and femininity are pervasive in cosmological conceptualizations of culture and nature, appear in folk classification systems, and influence men's and women's ecological and technical perceptions. Yet, with few exceptions (eg Descola 1992; Sillitoe 2003), such gender distinctions have not been used to understand the salience of agroecological *and* post-harvest or domestic selection criteria and the associated management of agrobiodiversity.

In Mexico, research such as that carried out in this Masters project should be extended to at least the three species of the '*milpa* triad' and as well to other communities that vary in the degree of commoditization of the crops under study and in the use of improved varieties, as well as in the degree of acculturation (traditional versus relatively 'mesticized' populations), which are factors that have been shown to have major effects on varietal diversity maintenance. However, such sites must be quite similar agroecologically, so as to maintain the latter influences as constant as possible. Moreover, perceptual distinctions between the sexes need to be examined through cultivar recognition, vernacular naming, etimologies and meanings, perceptual distinctions and the salience of selection criteria (Shigeta 1996; Ellen 1993; Boster 1985). These need to be inter-related with qualitative and quantitative data on gender divisions of labour and environmental, technical and cultural knowledge in the production-consumption chain and to cultural and material use values associated with different cultivars (Nazarea 2001; Zimmerer 1991), as well as with ethnographic data regarding gender relations and norms affecting varietal decision making.

[31]This section was developed together with Prof. Dr. Patricia Howard and is presented as a PhD proposal to WOTRO, the Dutch Science Council's Tropical Research division in April 2004.

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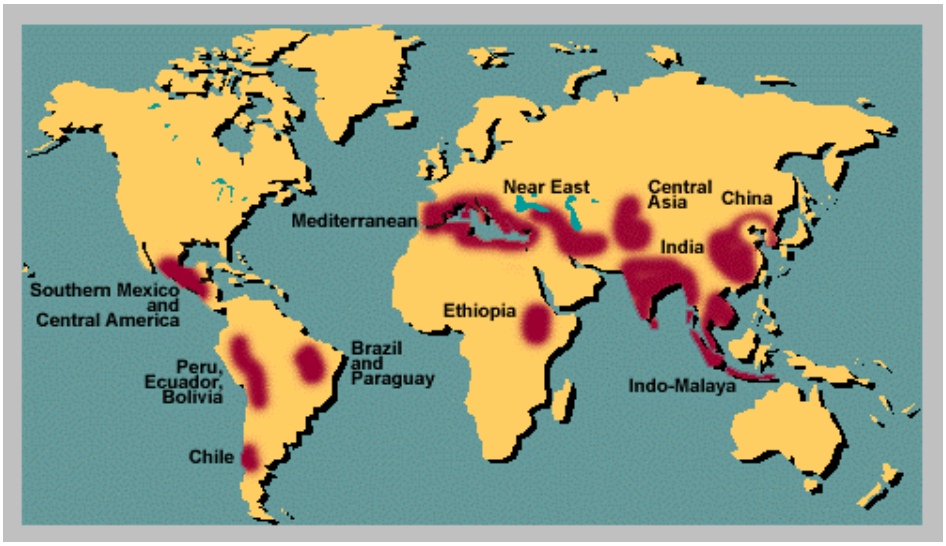
APPENDIX

Figure 1. Vavilov Centers of Plant Genetic Diversity: Areas of High Crop Diversity and Origins of Food Crops, according to N. Vavilov



1. **Ethiopia** . . . barley, coffee, sorghum
2. **Mediterranean** . . . oats, olives, wheat
3. **Asia Minor** . . . barley, lentil, oats, wheat
4. **Central Asia** . . . apple, chickpeas, lentil
5. **Indo-Burma** . . . eggplant, rice, yam
6. **Indo-Malaya** . . . banana, coconut, sugar cane
7. **China** . . . sorghum, millet, soybean
8. **Central America** . . . bean, corn, tomato
9. **Peru-Ecuador-Bolivia** . . . bean, potato, squash
10. **Southern Chile** . . . potato
11. **Brazil-Paraguay** . . . peanut
12. **North America** . . . sunflower
13. **West Africa** . . . millet, sorghum
14. **Northern Europe** . . . oats, rye

Source: Thrupp 1997 citing: N. Vavilov, 1949, *Chronica Botanica* Vol 13. Waltham, Massachusetts, adapted by Reid, Walter and Kenton Miller, 1989. *Keeping Options Alive: The Scientific Basis for Conserving Biodiversity.* World Resources Institute, Washington DC.

Figure 2. Recognition of homegardenhomegardens growing maize and squash in Yaxcaba, Yucatan, Mexico

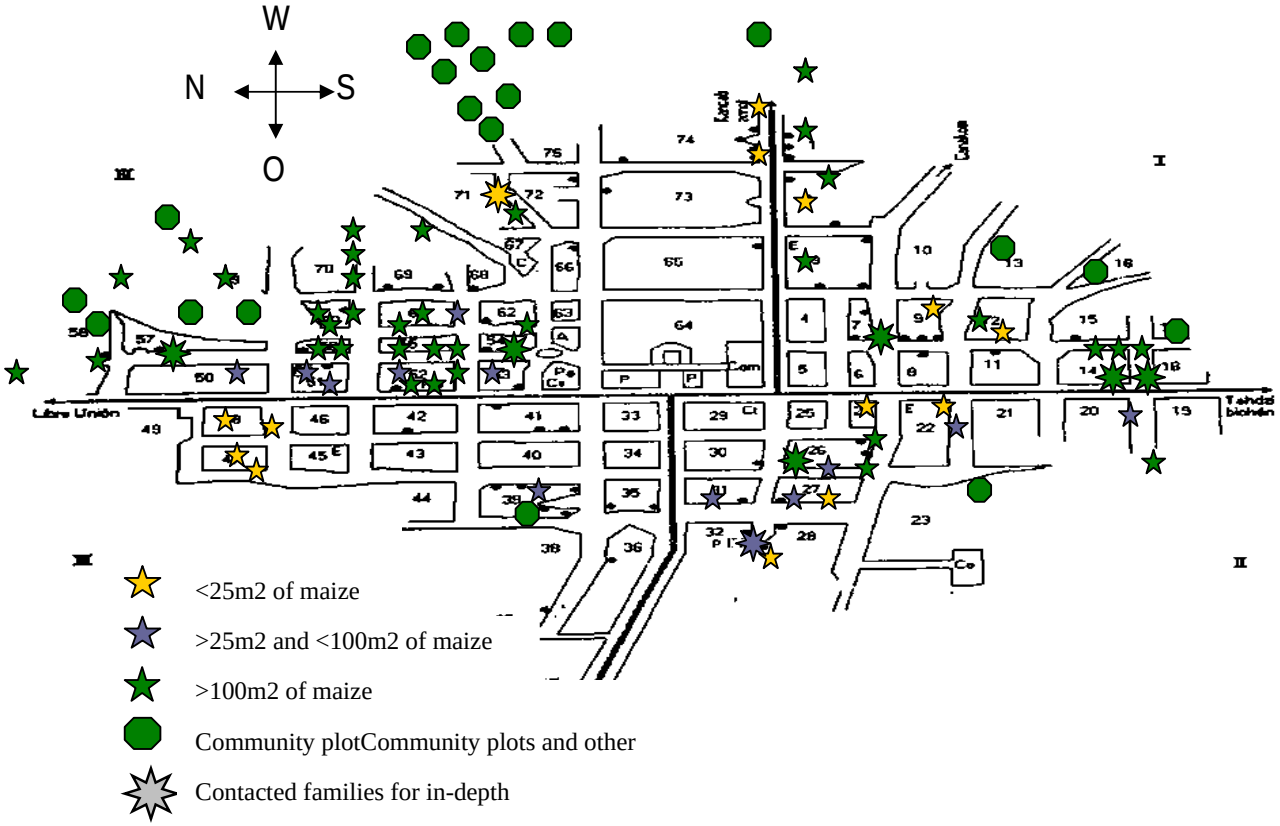


Table 1. Final forms of maize used: mentioned by women

Part of the plant/fruit	Uses mentioned by women*	Destination (domestic sphere: own-consumption/ market by type)	Varieties that can be used
Plant:			
Tassel	-To treat asthma disease (*5,7).	-Own-consumption (*5,7).	Any variety (*5,7).
Leaves and stem	-Livestock feeding when leaves are still green (*1,2,6,7,8, IC1).	-Own-consumption (bovino products destined to the very local market) (*1,2,6,7,8, IC1). -Local market for those who have the machinery to process the whole plant (still green) (*1,2,6,7,8, IC1).	Any variety (*1,2,6,7,8, IC1).
Stigma	-As a medicine for the kidneys (*1,2,3,5,6,7,8,IC1). Often given to children to treat urination problems.	-Own- consumption (*1,2,3,5,6,7,8,IC1).	Any variety (*1,2,3,5,6,7,8,IC1).
Root	---	---	---
Fruit:			
Tip grains (of ear)	-Boiled with stigma as a medicine given to children for urination (*1) -Chicken feeding (*1,7,8). -Pork feeding (*1,5,7) -If they look good, may be used as the rest of the grains (often for nixtamal), except as seed for next season (*2,3,4,IC1).	-Own-consumption (*1) -Own-consumption (*1,7,8). -Own-consumption (*1,5,7) -Own-consumption (*2,3,4,IC1).	Any variety (*1) Any variety (*1,7,8). Any variety (*1,5,7) ---
Young grains (color taken into consideration)	-To make (cook) 'atole nuevo' (*1,2,3,4,5,6,7,8,IC1). -To make (cook) 'is waaj' (*1,2,3,4,5,6,7,8,IC1). -As 'elote sancochado' (*1,2,3,4,5,6,7,8,IC1). -To make tamales colados (*4,5,6,7). -To make (cook) chanchamitos (*5) -To make (cook) pok binal (toast maize) (*6) -To make bread (pan de elote) (*6,7) -Boiled together with young xtop squash to prepare 'bebida de xtop' (*IC1)	-Own-consumption (*1,2,3,4,5,6,7,8,IC1). -Own-consumption (*1,2,3,4,5,6,7,8,IC1). -Own-consumption (*1,2,3,4,5,6,7,8,IC1). -Own-consumption (*4,5,6,7). -Own-consumption (*5). -Own-consumption (*6). -Own-consumption (*6,7) -Own-consumption (*IC1).	Any white either 'payis' or hybrid (*1,2,3,4,5,6,7,8,IC1). Any of the yellow or white maize they have (*1,2,3,4,5,6,7,8,IC1). Any variety (*1,2,3,4,5,6,7,8,IC1). Any white (*4,5,6,7). Any variety (*5). Any variety (*6). Any variety (*6,7) Any variety with very small grains (Xmejen nal preferred) (*IC1).
Mature grains (color taken into considera-tion)	-For nixtamal: to make (cook) tortillas (*1,2,3,4,5,6,7,8,IC1). -To aliviate diarrhea with burn tortilla (*5) -To feed animals (Chicken and pork) (*1,2,3,7,8,IC1). -To cook food-snack such as panuchos, empanadas, salbutes, pimitos, polcanes (*6). -To prepare relish/gravy in several dishes (*IC1)	-Own-consumption (*1,2,3,4,5,6,7,8,IC1). -Own-consumption (*5). -Own-consumption (*1,2,3,7,8,IC1). -Local market: she sells these food items to school teachers (*6). -Own-consumption (*IC1).	Any variety (*1,2,3,4,5,6,7,8,IC1). Any variety (*5). Any variety (*1,2,3,7,8,IC1). Any variety (*6). Any variety (*IC1).

	-To prepare relish/gravy in 'relleno negro' (*IC1)	-Own-consumption (*IC1).	Any variety but 'Xhe ub' (purple/black maize)' is preferred over any other due to its color (*IC1).
Husk ('joloch')	-As a wrapping to cook 'tobi-holoch' (*1,2,3,5,6,7,IC1). -As a fire starter/fuel (*4,5,7,8,IC1). -Livestock feeding (*1) -As construction material: made in strings and mixed with soil for wall construction (pa'ab luum) (*6).	-Own-consumption (*1,2,3,5,6,7,IC1). -Own-consumption (*4,5,7,8,IC1). -Own-consumption (*1) -They don't use it in this way but this is a well known form of use (*6).	Any variety (*1,2,3,5,6,7,IC1). Any variety (*4,5,7,8,IC1). Any variety (*1) Any variety (*6).
Cob ('bacal')	-Livestock feeding (green, not yet dried) (*1,8). -As fuel to cook in the 'comal' (dryed) (*1,2,3,4,5,6,7,8,IC1). -As a guiding base for squash plants (*6). -Hygienic use (as toilet paper) (*6).	-Own-consumption (*1,8). -Own-consumption (*1,2,3,4,5,6,7,8,IC1). -Own-consumption (*6). -They don't use it in this way but this is a well known form of use (*6).	Any variety (*1,8). Any variety (*1,2,3,4,5,6,7,8,IC1). Any variety (*6). Any variety (*6).
Peduncle ('chuch')	-Considered (and used) as part of the husk (*1,2,3)	-Own-consumption (*1,2,3)	Any variety (*1,2,3)

Table 2. Final forms of maize used: mentioned by men

Part of the plant/fruit	Uses mentioned by men*	Destination (domestic sphere: own-consumption/market -by type-)	Varieties that can be used
Plant:			
Tassel	-Bee-feeding (*1,IC2).	-Own-consumption (produced honey destined to local, national and export markets) (*1,IC2).	Any variety (*1,IC2).
Leaves and stem	-Livestock feeding when leaves are still green (*1,2, 4,7,8,IC2).	-Own-consumption (bovino products destined to the very local market) (*1,2, 4,7,8,IC2). -Local market for those who have the machinery to process the whole plant (still green) (*1,7,8).	Any variety (*1,2, 4,7,8,IC2).
Stigma	-As a medicine for the kidneys (*1,3,5,7,8). Often given to children to treat urination problems. -As a medicine for kidneys, boiled together with other plants ('elemuy' and 'dormilona') -For camote (yam) sowing. He wraps the camote (yam) with the stigma so is no loosen in the ground (*2).	-Own- consumption (*1,3,5,7,8,IC2). -Local market: to whoever attends the traditional medicine center in the village (*IC3). -Own- consumption (*2).	Any variety (*1,3,5,7,8,IC2). Any variety (*IC3). Any variety (*2).
Root	-Livestock feeding (*1). -For soil recovering, just left in the field after harvest (*IC2).	-Own-consumption (*1). -Own-consumption (*IC2).	Any variety (*1). Any variety (*IC2).
Fruit:			
Tip grains (of ear)	-Chicken feeding (*1,2,3,7,8,IC2). -Pork feeding (*5,7,IC2) -If they look good, may be used as the rest of the grains, except as seed for next season (*1,2,3,4,5,7,IC2).	-Own-consumption (*1,2,3,7,8, IC2). -Own-consumption (*5,7, IC2) -Own-consumption (*1,2,3,4,5,7, IC2).	Any variety (*1,2,3,7,8, IC2). Any variety (*5,7, IC2) ---
Back grains (of ear)	-Same as with tip grains: if they look good, may be used as the rest of the grains, except as seed for next season (*2,3).	-Own-consumption (*2,3).	---
Young grains (color taken into considera-tion)	-To make (cook) '*atole nuevo*' (*1,2,3,4,5,6,7,8, IC2). -To make (cook) '*is waaj*' (*1,2,3,4,5,6,7,8, IC2). -As 'elote sancochado' (*1,2,3,4,5,6,7,8, IC2). -To make tamales colados (*7). -To make 'Center-Mexico style tamales' (made by him, he learned about this out-of-the-area dish when he was working in Cancun) (*2). -To make bread (pan de elote) (*6,7)	-Own-consumption (*1,2,3,4,5,6,7,8, IC2). -Own-consumption (*1,2,3,4,5,6,7,8, IC2). -Own-consumption (*1,2,3,4,5,6,7,8,IC2). -Own-consumption (*7). -Own-consumption (*2). -Own-consumption (*6,7)	Any white either 'payis' or hybrid (*1,2,3,4,5,6,7,8, IC2). Any of the yellow or white maize they have (*1,2,3,4,5,6,7,8, IC2). Any variety (*1,2,3,4,5,6,7,8,IC2). Any white (*7). Any of the yellow or white maize they have (*2). Any variety (*6,7)
Mature grains	-For nixtamal: to make (cook) tortillas (*1,2,3,4, 5,6,7,8,IC2).	-Own-consumption (*1,2,3,4, 5,6,7,8,IC2).	Any variety (*1,2,3,4, 5,6,7,8,IC2).

(color taken into consideration)	-For nixtamal: to cook 'panuchos' and 'salbutes' (*6). -To feed animals (Chicken and pork) (*1,2,7,IC2). -For seed selling (*IC2) -To make 'saka' and spell it over the person with a disease or a 'harmed wind' in a ritual (cleaning or 'limpia') (*IC3). -Many years ago, a red variety of maize (chac chob) used to be wear as a necklace to treat 'sarampion' and 'tos ferina' (*IC3).	-Local market: wife sells these food to school teachers (*6). -Own-consumption (*1,2,7,IC2). -Very local market (friends, neighbours and relatives) (*IC2) -Local market: to whoever attends the traditional medicine center in the village (*IC3). -No currently used. Nowadays, vaccination has replaced such use of maize (*IC3).	Any variety (*6). Any variety (*1,2,7,IC2). Xoy (sold about 30 kgs. last cycle) (IC2). Any white, because is associated with the 'Xaman' wind of the North (*IC3). Only chac chob can be used (a red maize) (*IC3).
Husk ('joloch)'	-As a wrapping to cook *'tobi-holoch'* (*1,2,3,5,6,7,IC2). -As a fire starter/fuel (*6,7,8,IC2).	-Own-consumption (*1,2,3,5,6,7,IC2). -Own-consumption (*6,7,8,IC2).	Any variety (*1,2,3,5,6,7,IC2). Any variety (*6,7,8,IC2).
Cob ('bacal')	-Livestock feeding (green, not yet dried) (*1,8). -As fuel to cook in the '*comal*' (dryed) (*1,2,3,4,5,6,7,IC2). -Hygienic use (as toilet paper) (*6). -To burn in 'ahumador' and produce smoke to avoid bee biting (*IC2). -The last nine rings in the tip (has almost no grains) are boiled with honeybee and given to cure 'hypo', a harm-wind inside the body(*IC3).	-Own-consumption (*1,8). -Own-consumption (*1,2,3,4,5,6,7,IC2). -They don't do it but this is a very known form of use (*6). -Own-consumption though honey bee is for local, national and export markets (*IC2). -Local market: to whoever attends the traditional medicine center in the village (*IC3).	Any variety (*1,8). Any variety (*1,2,3,4,5,6,7,IC2). Any variety (*6). Any variety (*IC2). Any variety (*IC3).
Peduncle ('chuch')	-Considered (and used) as part of husk (*1,2,3).	-Own-consumption (*1,2,3).	Any variety (*1,2,3).

Table 3. Final forms of squash uses: mentioned by women

Part of the plant/fruit	Uses mentioned by women*	Destination (domestic sphere: own-consumption/ market by type)	Varieties that can be used (Xnuk kuum, Xmejen kuum, Xtop, Tzol)
Roots and stem	-For animal feeding (horse, pork) (*IC1).	-Own-consumption (*IC1).	All four varieties (*IC1).
Leaves	-To soft maize in nixtamal after boiling (*2,6,7,8)	-Own-consumption (*2,6,7,8).	All four varieties (*2,6,7,8).
	-For animal feeding (horse, pork) (*IC1).	-Own-consumption (*IC1).	All four varieties (*IC1).
Blossom or flower	-To prepare 'joroch' soup in co'ol (maize gravy) (*1,2,3,4,5,7, IC1)	-Own-consumption (*1,2,3,5,7,IC1).	Xtop (*1,3,4,5,IC1). All four varieties (*2,3).
Seed ('pepita')	-Grounded to prepare 'pipian' (*1,2,3,4,5,6,7,8, IC1).	-Own-consumption (*1,2,3,4,5,6,7,8,IC1).	Those of pepita menuda (Xnuk kuum, Xmejen kuum) (*1,2,3,4,5,6,7,8, IC1).
	-To prepare 'tok sel' (*1,3,4,5,6,7,IC1).	-Own-consumption (*1,3,4,5,6,7,IC1).	Those of pepita menuda (Xnuk kuum, Xmejen kuum) (*1,3,4,5,6,7,IC1).
	-To prepare 'sikil cab' candy (*1,3,4,5,6,7,IC1).	-Own-consumption (*1,3,4,5,6,7,IC1).	Those of pepita menuda (Xnuk kuum, Xmejen kuum) (*1,3,4,5,6,7,IC1).
	-To prepare 'chujucsikilxtop' (grounded-seed candy) (*1,4,5,6,7,IC1).	-Own-consumption (*1,4,5,6,7,IC1).	Xtop (*1,4,5,6,7,IC1).
	-Toasted, eaten as snack with salt and chile added (*2,3,4,5,6,7,8,IC1).	-Own-consumption (*2,3,4,5,6,7,8,IC1).	Xtop (*2,3,4,5,6,7,8,IC1).
	-As seed to sow again (*2,5,6,7,IC1).	-Own-consumption (*2,5,6,7,IC1). -Very local market: to those who stop by the house asking for seed (*5,6,7,IC1).	All four varieties (*2,5,6,7,IC1). Xnuk kuum, Xtop (*5,6,IC1).
	-As beverage mixed with nixtamal (bebida de xtop) (*5).	-Own-consumption (*5).	Xtop (*5).
	-To prepare 'papadzules' relish (*6,7,8,IC1)	-Own-consumption (*6,7,8,IC1).	Xtop (*6,7,8,IC1).
	-In 'tsotobichay' (maize and chaya leaves (*IC1).	-Own-consumption (*IC1).	Those of pepita menuda (Xnuk kuum, xmejen kuum) (*IC1).
Young fruit (flesh) ('chayipach')	-To eat toasted in the 'comal' and add salt added (*1,3).	-Own-consumption (*1,3).	Those of pepita menuda (Xnuk kuum, xmejen kuum) (*1,3).
	-To eat boiled and smashed with sugar added (*1,3,IC1).	-Own-consumption (*1,3,IC1).	Those of pepita menuda (Xnuk kuum, xmejen kuum) (*1,3,IC1).
	-To eat boiled and cut in squares with salt added (*7).	-Own-consumption (*7)	All four varieties (*7).
	-For animal feeding (pork) (*1,3,IC1).	-Own-consumption (*1,3,IC1).	Xnuk kuum, Xtop (*1,IC1). Xnuk kuum (*3).
	-Boiled, then flavor add (sour orange, lard or manteca, recado, ground pepper) (*2,3,5,6,IC1).	-Own-consumption (*2,3,5,6,IC1)	All four varieties (*2,3,5,6,IC1). Xnuk kuum (*5).
	-Boiled and smashed, then seasoned plus cheese in top, eaten with tostadas (*6).	-Own-consumption (*6).	All four varieties (*6).
	-Boiled in chicken or beef soups (caldos) (*4,6,7,IC1).	-Own-consumption (*4,6,7,IC1).	All four varieties (*4,6,7,IC1).

	-Fried with onion and lard ('manteca)' (*5,8).	-Own-consumption (*5,8).	Xnuk kuum, Xtop (*5,8).
	-Fried with green (snow) peas (*6).	-Own-consumption (*6).	All four varieties (*6).
	-As stuffing in empanadas with bean-soup (*6).	-Own-consumption (*6).	All four varieties (*6).
		-Local market: sell to school teachers (*6).	All four varieties (*6).
	-Boiled with fideo pasta (*8).	-Own-consumption (*8).	All four varieties (*8).
	-As a vitamin source when somebody is sick (*IC1).	Own-consumption (*IC1).	Tzol (*IC1).
	-Stuffed squash (*5,6,7,IC1).	-Own-consumption (*5,6,7,IC1).	Xnuk kuum (*5,6,7,IC1).
Mature fruit (flesh)	-Boiled, then sugar added and eaten with a spoon by rubbing the fruit (*2,3,5,8,IC1).	-Own-consumption (*2,3,5,8,IC1).	Xnuk kuum (*2,3,5,8).
			Xtop (*IC1).
	-Boiled in soups ('caldos') (*2,3, IC1).	-Own-consumption (*2,3, IC1).	Xmejen kuum, Tzol (*2,3,IC1).
	-Boiled with honey inside ('calabaza melada') (*4,7,IC1).	-Own-consumption (*4,7,IC1).	Xnuk kuum, Xmejen kuum (*4,7,IC1).
	-Boiled with sugar inside (*4,IC1).	-Own-consumption (*4,IC1).	Tzol (*4).
			Xnuk kuum, Xmejen kuum (*IC1).
	-Boiled and eaten as it were in young state (*6,7).	-Own-consumption (*6,7).	Tzol (*6).
			Xmejen kuum (*7).
	-Ground-cook squash (*2,3,5,6,7).	-Own-consumption (*2,3,5,6,7).	All four varieties (*2,3,5,6,7).
	-For animal feeding (*2,3, 5,6,7).	-Own-consumption (*2,3,5,6,7).	Xnuk kuum, Xmejen kuum (*2,3,5,6).
			Xnuk kuum (*7).
	-To save the squash seed (*1,7,IC1).	-Own-consumption (*1,7,IC1).	Xnuk kuum, xmejen kuum, tzol (*1,7,IC1).
Peel	-To save the squash seed (*1,7).	-Own-consumption (*1,7).	All four varieties (*1,7).
	-For animal feeding (pork, chicken) (*2,3,5,6,7,8,IC1).	-Own-consumption (*2,3,5,6,7,8,IC1).	Xnuk kuum, Xmejen kuum (*2,3,5,6,7,8,IC1).
	-Eaten as the rest of the fruit (boiled in mature state) (*6,7).	-Own-consumption (*6,7).	Tzol (*6).
			Xmejen kuum (*7).
Peduncle (chuch)	-As a medicine for the kidneys, to treat urination problems: boiled together with maize stigma (*1,3)	-Own-consumption (*1,3).	Xnuk kuum, xmejen kuum (*1,3).
	-As a medicine for the kidneys to disolve calcifications: boiled with maize stigma and chaya plant's roots (*5).	-Own-consumption or very local market to whoever ask her for traditional medication (*5).	Xnuk kuum (*5).
	-As a kitchen tool to smash ('tamulate ') chile and tomatoes (*2,3).	-Own-consumption (*2,3).	Xnuk kuum (*2,3).

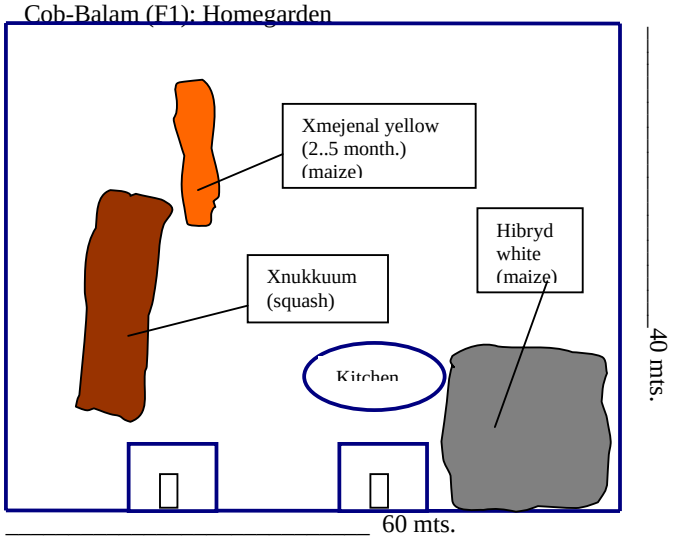
Table 4. Final forms of squash uses: mentioned by men

Part of the plant/fruit	Uses mentioned by men*	Destination (domestic sphere: own-consumption/ market by type)	Varieties that can be used (Xnuk kuum, Xmejen kuum, Xtop, Tzol)
Roots and stems	-For animal feeding (horse, pork) (*IC2).	-Own-consumption (*IC2).	All four varieties (*IC2).
Leaves	-For animal feeding (horse, pork) (*IC2).	-Own-consumption (*IC2).	All four varieties (*IC2).
	-To heal skin-wounds (boiled in water and put in on the affected area) (*IC3).	-Local market: to whoever attends the traditional medicine center in the village (*IC3).	All four varieties (*IC3).
Blossom or flower	-To prepare 'joroch' soup in 'co'ol' (maize gravy) (*2,3,5,7,8,IC2).	-Own-consumption (*2,3,5,7,8,IC2).	Xnuk kuum (*2,3,5,7,8,IC2).
Seed ('pepita')	-Grounded to prepare 'pipian' (*1,2,3,5,6,7,8,IC2).	-Own-consumption (*1,2,3,5,6,7,8).	Those of pepita menuda (Xnuk kuum, Xmejen kuum) (*1,2,3,5,6,7,8).
	-To prepare 'sikil cab' candy (*1,2,3,6,7,IC2).	-Own-consumption (*1,2,3,6,7).	Those of pepita menuda (Xnuk kuum, Xmejen kuum) (*1,2,3,6,7).
	-Takes it home and then women decide how to prepare it (*4).	-Own-consumption (*4).	Xnuk kuum, Xtop (*4).
	-To prepare 'chujucsikilxtop' (grounded-seed candy) (*IC2).	-Own-consumption (*IC2).	Xtop (*IC2).
	-Toasted, eaten as snack with salt and chile added (*2,3,7,8,IC2).	-Own-consumption (*2,3,7,8,IC2).	Xtop (*2,3,7,8,IC2).
	-As seed to sow again (*2,3,5,6,8,IC2).	-Own-consumption (*2,3,5,6,8,IC2). -Very local market: to those who stop by the house asking for seed (*IC2).	All four varieties (*2,3,5,6,8,IC2). Xnuk kuum, Xtop (*IC2).
	-To prepare 'papadzules' relish (*8,IC2)	-Own-consumption (*8,IC2).	Xtop (*8,IC2).
	-To alleviate skin itching (grounded and made as a cream, then applied to the affected area) (*IC3).	-Local market: to whoever attends the traditional medicine center in the village (*IC3).	Any squash variety (*IC3).
Young fruit (flesh)	-Can be eaten boiled or fried alone or with other items ((i.e. with sour orange and chile) (*1,5,6,7,8).	-Own-consumption (*1,5,6,7,8).	All four varieties (*1,5,6,7,8).
	-Boiled in chicken or beef soups (caldos) and or with other vegetables (*2,3,4,6,IC2).	-Own-consumption (*2,3,4,6,IC2).	All four varieties (*2,3,4,6,IC2).
	-Fried with onion and lard ('manteca)' (*3,5,6).	-Own-consumption (*3,5,6).	Xnuk kuum, Xtop (*3,5,6).
	-Boiled with fideo pasta (*8).	-Own-consumption (*8).	All four varieties (*8).
	-Eaten with sugar and eaten with a spoon by rubbing the fruit (*1,3).	-Own-consumption (*1,3).	Xnuk kuum (*1,3).
Mature fruit (flesh)	-For animal feeding (*1,6,7,IC2).	-Own-consumption (*1,6,7,IC2).	Xnuk kuum (*1,6,7,IC2).
	-For bee-feeding (boiled with sugar) (*1, IC2).	-Own-consumption (produced honey destined to local, national and export markets) (*1,IC2).	Xnuk kuum (*1,IC2).
	-Boiled, then sugar added and eaten with a spoon by rubbing the fruit (*2,5,7,8).	-Own-consumption (*2,5,7,8).	Xnuk kuum (*2,5,7,8).
	-Boiled and eaten as it were in young state (*6,7).	-Own-consumption (*6,7).	Tzol (*6,7).
	-Ground-cook squash (*2).	-Own-consumption (*2).	Xnuk kuum, Xmejen kuum, Tzol (*2).

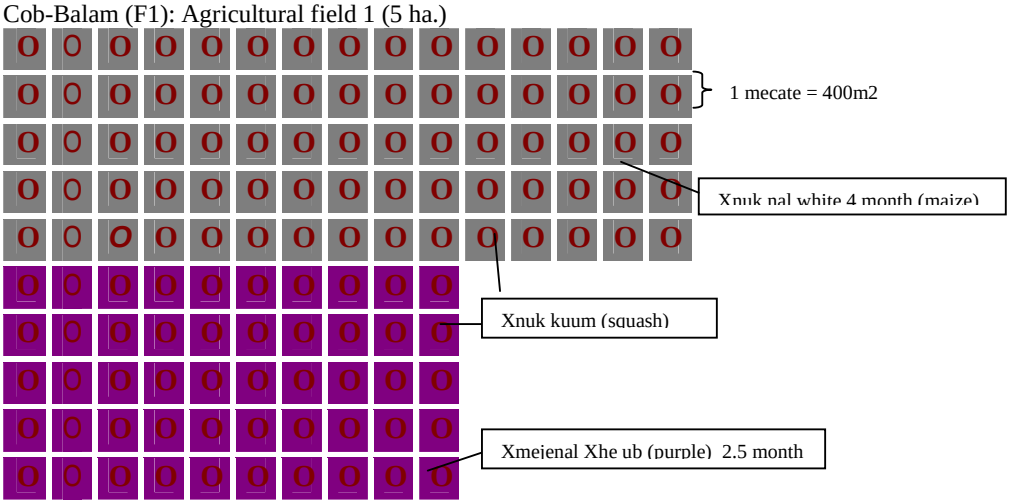
	-To save the squash seed (*1,4,7). -Eaten as sweet (*1). -For animal feeding (cook for pigs, raw for beef) (*7).	-Own-consumption (*1,4,7). -Own-consumption (*1). -Own-consumption (*7).	All four varieties (*1,4, 7). Xnuk kuum (*1). Xnuk kuum (*7).
Peel	-For animal feeding (pork, chicken,horse) (*2,3,4,5,6,7,8,IC2). -Eaten as the rest of the fruit (boiled in mature state) (*6,7).	-Own-consumption (*2,3,4,5,6,7,8,IC2). -Own-consumption (*6,7).	Xnuk kuum, Xmejen kuum (*2,3,4,5,6,7,8,IC2). Tzol (*6). Xmejen kuum (*7).
Peduncle (chuch)	-As a medicine for the kidneys, to treat urination problems: boiled together with maize stigma (*1)	-Own-consumption (*1).	Xnuk kuum, xmejen kuum (*1).
	-As a medicine for the kidneys, boiled together with maize stigma and other plants (*5,IC3).	-Own-consumption or very local market to whoever ask his wife for traditional medication (*5,IC3).	Xnuk kuum (*5,IC3).
	-As a kitchen tool to smash (‘tamulate ’) chile and tomatoes (*2,IC2).	-Own-consumption (*2,IC2).	Xnuk kuum (*2,IC2).

Maps : Family 1 : Cob-Balam (memory maps and drawings from transect walks)

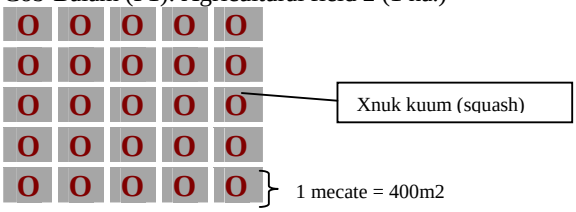
Cob-Balam (F1): Homegarden



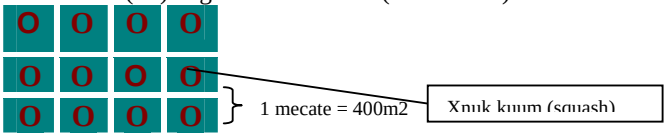
Cob-Balam (F1): Agricultural field 1 (5 ha.)



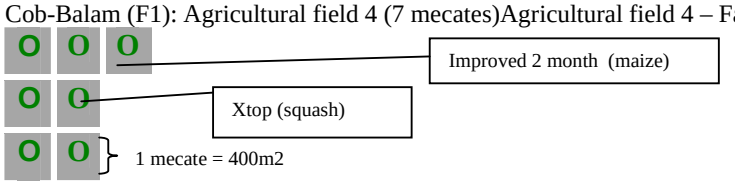
Cob-Balam (F1): Agricultural field 2 (1 ha.)



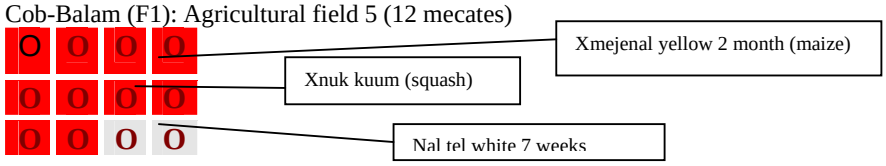
Cob-Balam (F1): Agricultural field 3 (12 mecates)



Cob-Balam (F1): Agricultural field 4 (7 mecates)Agricultural field 4 – Family 1 (Cob-Balam)

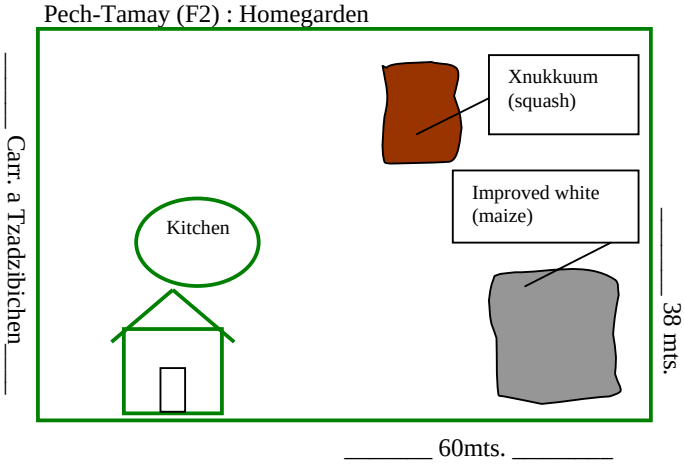


Cob-Balam (F1): Agricultural field 5 (12 mecates)

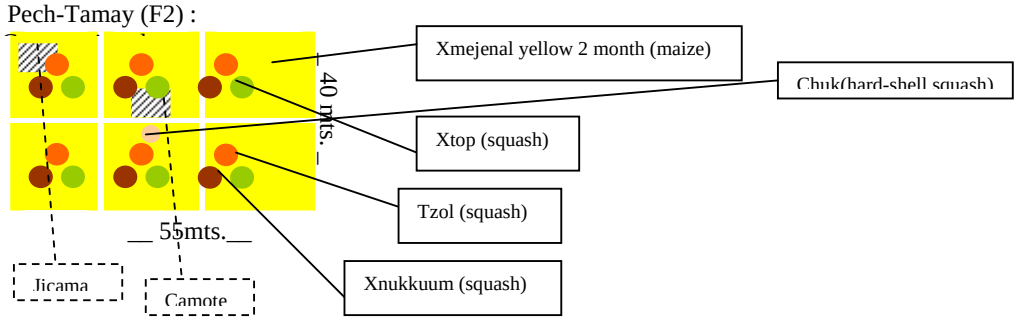


Maps: Family 2 : Pech-Tamay (memory maps and drawings from transect walks)

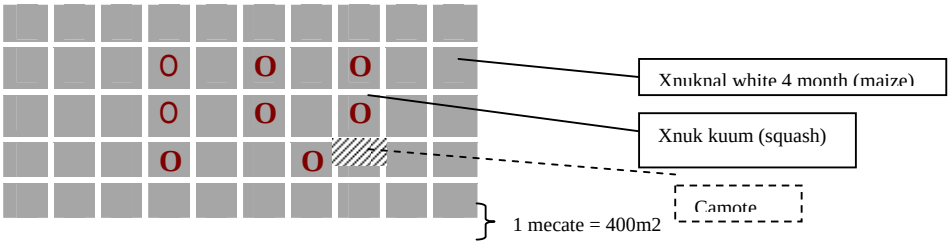
Pech-Tamay (F2) : Homegarden



Pech-Tamay (F2) :

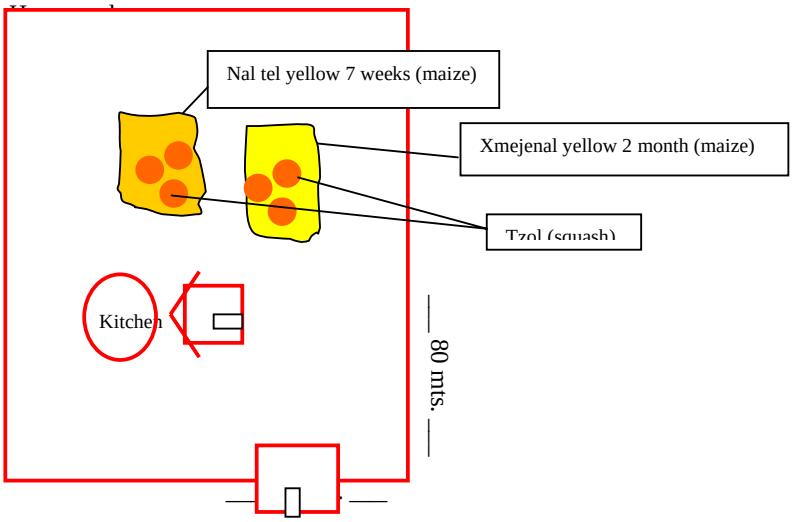


Pech-Tamay (F2) : Agricultural field (single field)50 mecates

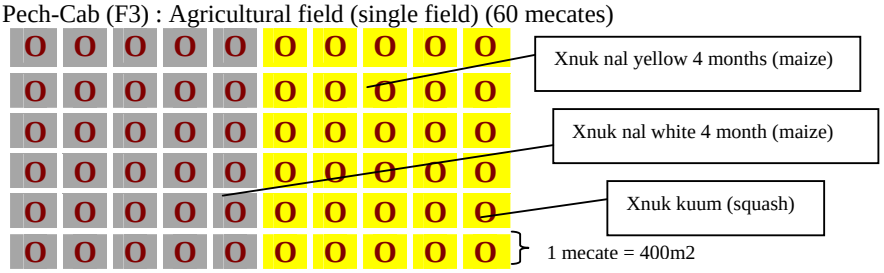


Maps: Family 3 : Pech-Cab (memory maps and drawings from transect walks)

Pech-Cab (F3):

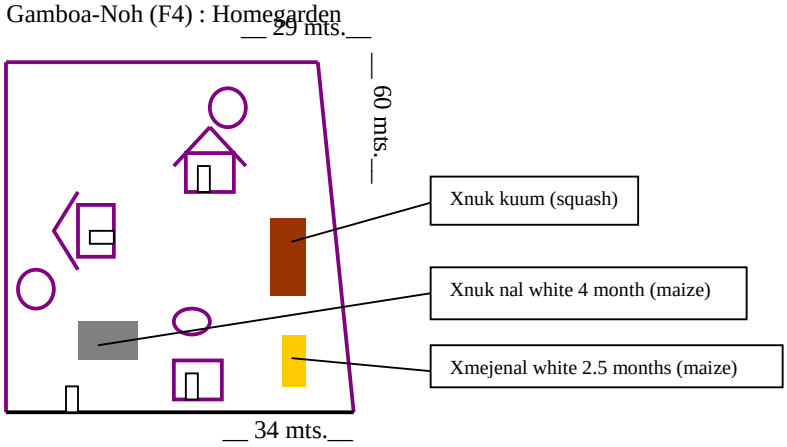


Pech-Cab (F3) : Agricultural field (single field) (60 mecates)

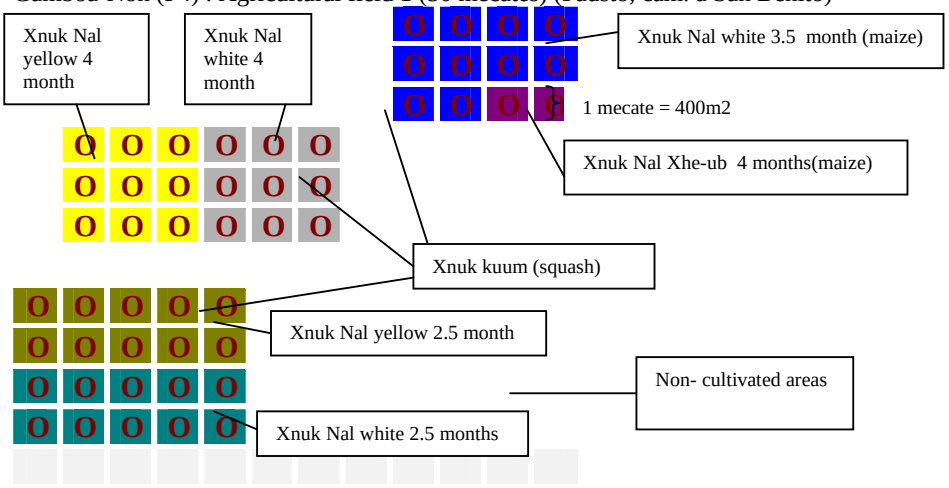


Maps: Family 4 : Gamboa-Noh (memory maps and drawings from transect walks)

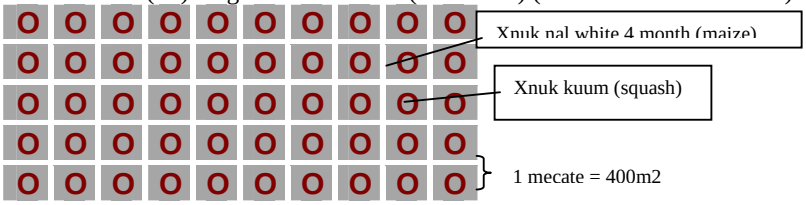
Gamboa-Noh (F4) : Homegarden



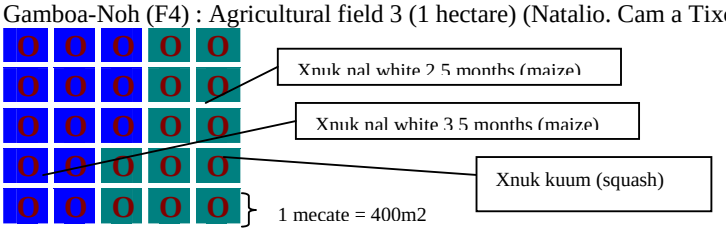
Gamboa-Noh (F4) : Agricultural field 1 (50 mecates) (Fausto, cam. a San Benito)



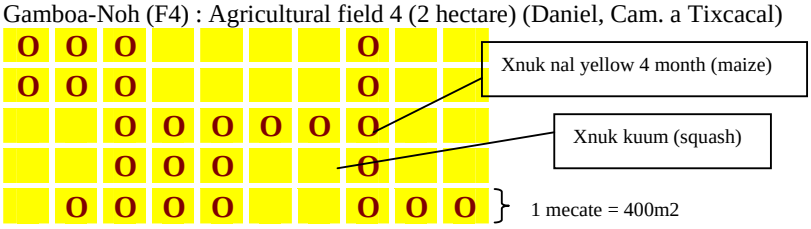
Gamboa-Noh (F4) : Agricultural field 2 (2 hectares) (Natalio. Cam a Tixcacal)



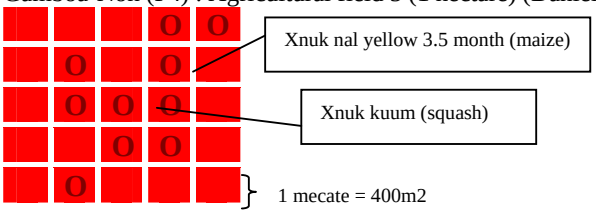
Gamboa-Noh (F4) : Agricultural field 3 (1 hectare) (Natalio. Cam a Tixcacal)



Gamboa-Noh (F4) : Agricultural field 4 (2 hectare) (Daniel, Cam. a Tixcacal)

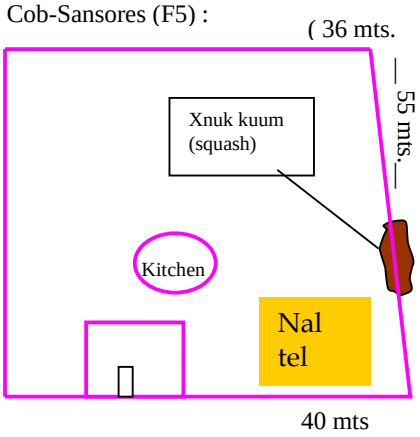


Gamboa-Noh (F4) : Agricultural field 5 (1 hectare) (Daniel, Cam. a Tixcacal)

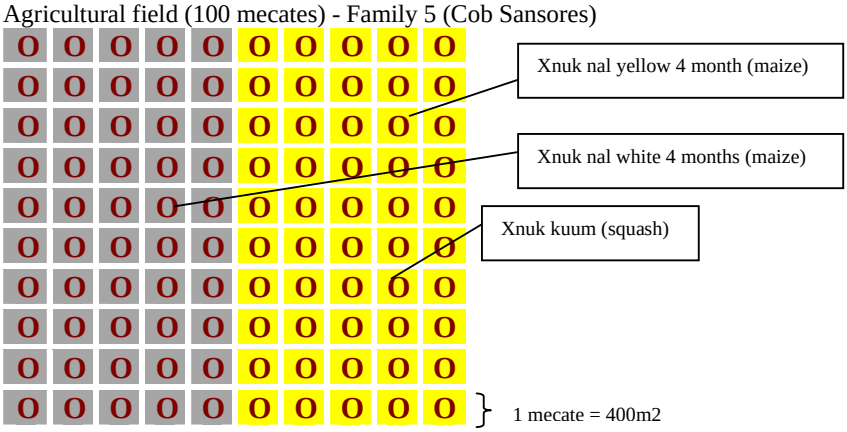


Maps: Family 5 : Cob-Sansores (memory maps and drawings from transect walks)

Cob-Sansores (F5) :

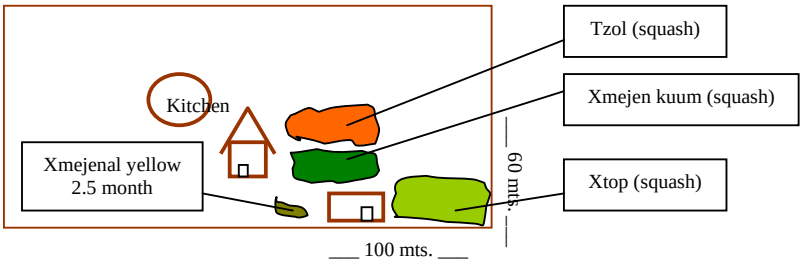


Agricultural field (100 mecates) - Family 5 (Cob Sansores)

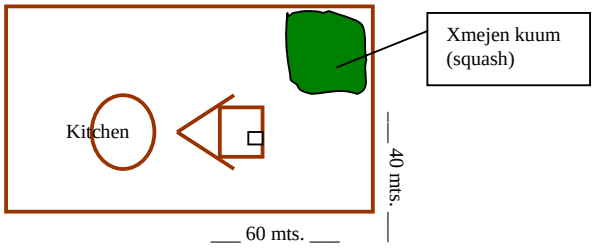


Maps: Family 6 : Tello-Tec (memory maps and drawings from transect walks)

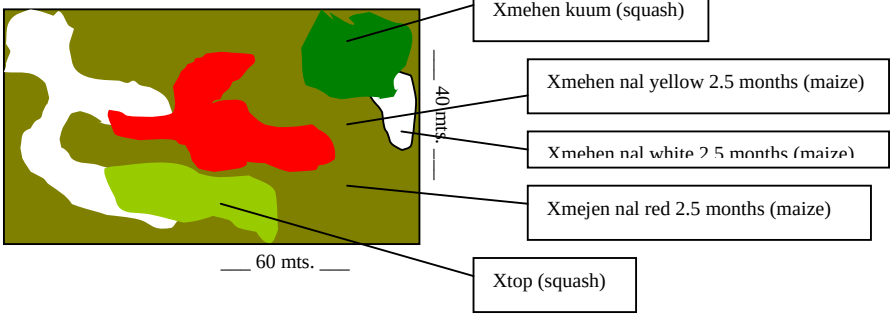
Tello-Tec (F6) : Homegarden 1



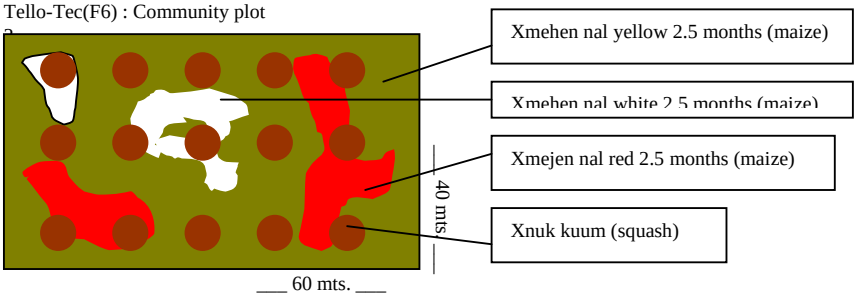
Tello-Tec (F6) : Homegarden 2



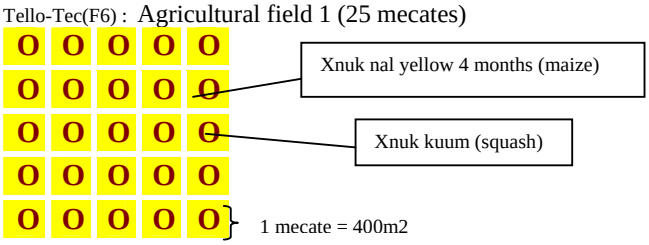
Tello-Tec(F6) :



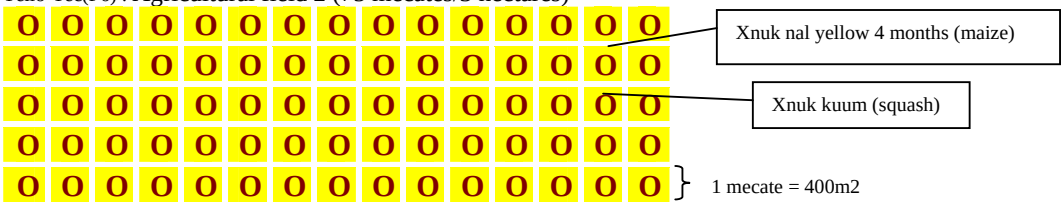
Tello-Tec(F6) : Community plot



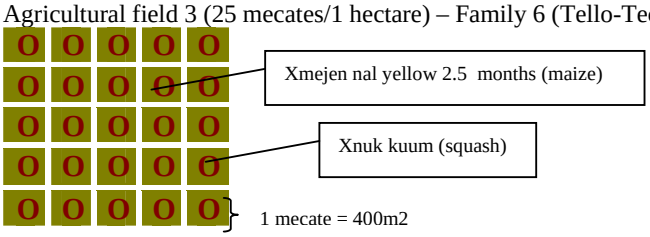
Tello-Tec(F6) : Agricultural field 1 (25 mecates)



Tello-Tec(F6) : Agricultural field 2 (75 mecates/3 hectares)

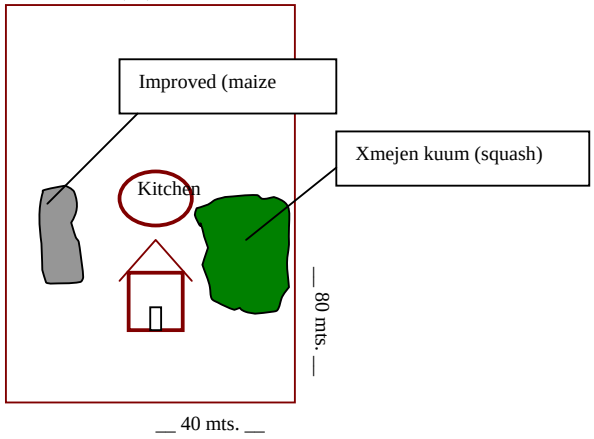


Agricultural field 3 (25 mecates/1 hectare) – Family 6 (Tello-Tec)

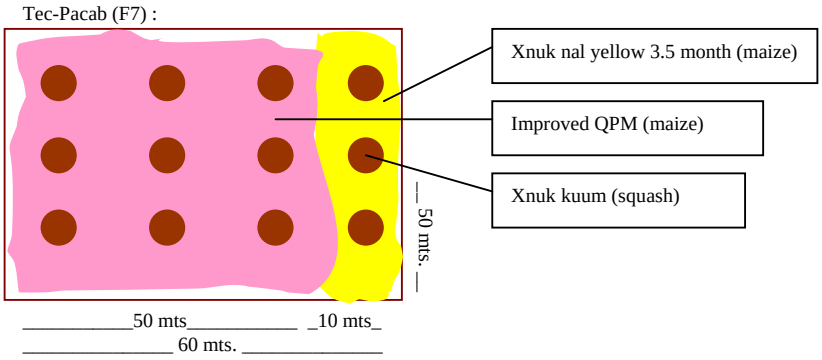


Maps: Family 7 : Tec-Pacab (memory maps and drawings from transect walks)

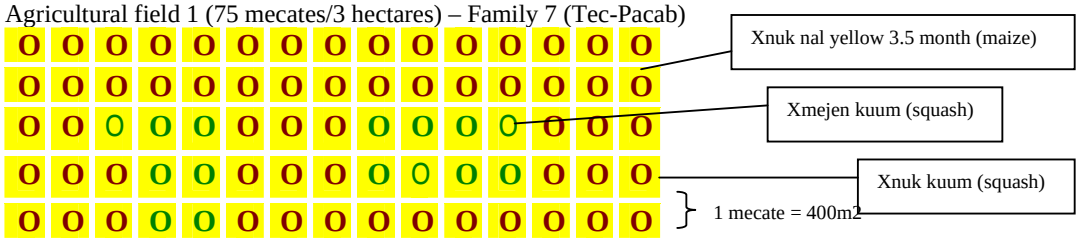
Tec-Pacab (F7) :



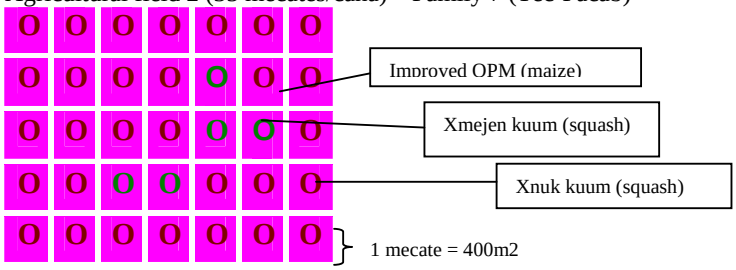
Tec-Pacab (F7) :



Agricultural field 1 (75 mecates/3 hectares) – Family 7 (Tec-Pacab)

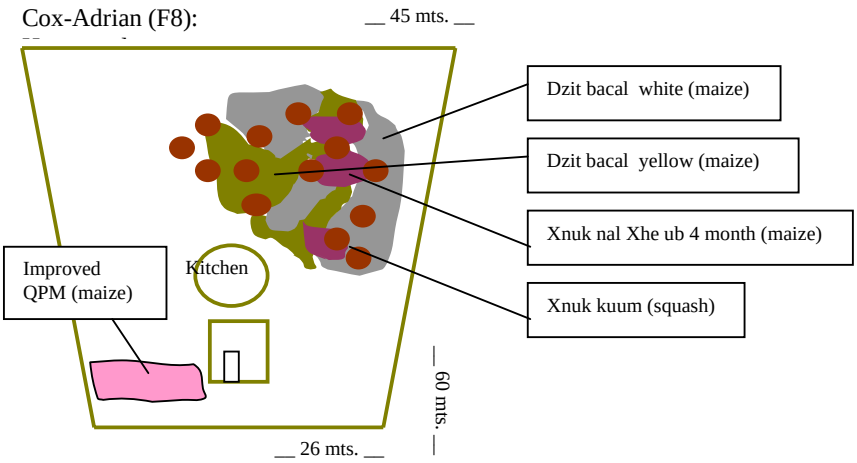


Agricultural field 2 (35 mecates/cana) – Family 7 (Tec-Pacab)

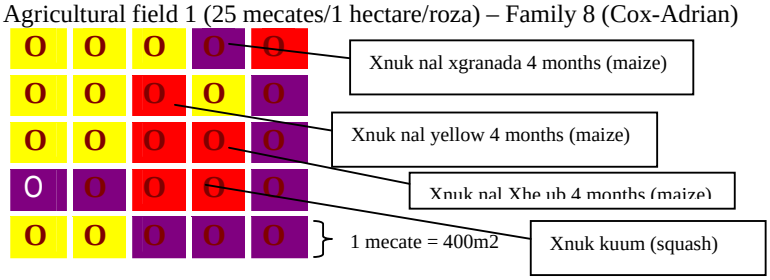


Maps: Family 8 : Cox-Adrian (memory maps and drawings from transect walks)

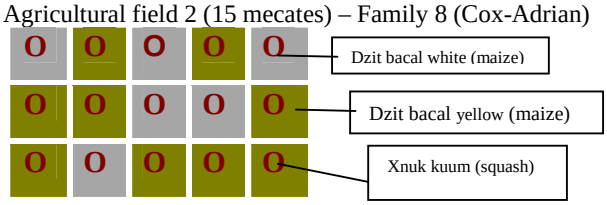
Cox-Adrian (F8):



Agricultural field 1 (25 mecates/1 hectare/roza) – Family 8 (Cox-Adrian)



Agricultural field 2 (15 mecates) – Family 8 (Cox-Adrian)



Photographs of the encountered diversity[32]

Maize landraces

Xnuk nal
white
4 month

Xnuk nal
yellow
4 month

Xnuk nal
Xgranada
4 month

Xnuk nal
Chac chob
4 month

Xnuk nal
Xhe ub
4 month

Xnuk nal
Pix-Cristo
4 month

Xmejen nal
yellow
2.5 month

Xmejen nal
yellow
3 month

Xmejen
nal
Xhe ub

Dzit bacal
white
3.5 month

Dzit bacal
yellow
3.5 month

Nal tel
yellow
7 weeks

Nal tel
white
7 weeks

Maize local-crossed population

'Nal Xoy'
3 month

Maize improved populations

'V-528'
2.5 month

'V-532'
3 month

'V-527'
2.5 month

'V-533'
4 month

'VS-536'

[32] Maize pictures taken from the maize collection available at the Centro de Desarrollo Social collected by the research team of Dr. Heriberto Cuanalo from Cinvestav-IPN.

Squash landraces

‘Xnuk kuum’ (seed, young fruit and mature fruit)



‘Xmejen kuum’ (young fruit and mature fruit)


‘Xtop’ (seed, young fruit and mature fruit)



‘Tzol’ (seed and mature fruit)


Forms of storage

Troje

Improved maize
(to be consumed in a few days)

Nal Tel
(to be consumed in a few days)