

SEEDS OF LIFE (SoL)
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SOCIO-ECONOMIC STUDY (SOSEK)

**CULTIVATION PRACTICES FOR STAPLE FOODS
INCLUDING DIVISION OF LABOUR AND
AGRICULTURAL RITUAL: A STUDY OF SEEDS OF
LIFE FARMERS IN AILEU, BAUCAU, LIQUICA AND
MANUFAHI DISTRICTS**

APRIL 2006 – MARCH 2007

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Acronyms

ACIAR	Australian Centre for International Agricultural Research
AUSAID	Australia Agency for International Development
OFDT	On-farm demonstration trial
MAFF	Ministry of Agriculture, Fisheries and Forestry, Timor-Leste
MTR	Mid-Term Review of SoL (June 2007)
SOSEK	Socio-economic research program, SoL

Glossary

<i>ai besi (T)</i>	digging stick made from iron
<i>ai farinha (T)</i>	cassava
<i>ai han menus (T)</i>	annual food shortage period usually 1-3 months before the new maize harvest
<i>ai leten (T)</i>	above the hearth
<i>ai rin tara (T)</i>	frame made from two vertical uprights and one horizontal pole used to suspend maize tied into wreaths
<i>ai suak (T)</i>	digging stick made from wood
<i>au dora (T)</i>	bamboo tube in which ceremonial rice may be cooked, or seed stored
<i>ai sar kesak (T)</i>	broom made from palm spine
<i>aten (T)</i>	sculletum
<i>bandu (T)</i>	taboo, prohibited
<i>batar(T)</i>	maize
<i>be'en (T)</i>	sap, fluid
<i>belit (T)</i>	sticky
<i>biti (T)</i>	mat woven from palm leaf on which garden produce is laid to dry in the sun
<i>bokar (T)</i>	rounded
<i>bokur (T)</i>	fertile
<i>buras (T)</i>	fertile
<i>ceremonia lulik (T)</i>	sacred or religious ritual
<i>enxada (T)</i>	hoe
<i>etu (T)</i>	cooked rice
<i>familia (T)</i>	several related households including siblings and families on both husband and wife's sides
<i>fatuk belar (T)</i>	sacred stone on which sacrificial objects are placed
<i>fehuk (T)</i>	sweet potato
<i>fini (T)</i>	seed
<i>fokit (T)</i>	to pull out (e.g., weeds)
<i>fore rai (T)</i>	peanuts
<i>fos (T)</i>	milled rice
<i>fuan (T)</i>	seed
<i>fukun (T)</i>	leaf node
<i>hadak leten (T)</i>	elevated shelf above kitchen hearth used for drying and storing produce
<i>halai natar (T)</i>	to puddle a ricefield using buffalo
<i>hamos duut (T)</i>	to weed
<i>hare (T)</i>	unmilled rice
<i>hokan (T)</i>	woven basket
<i>isin (T)</i>	flesh
<i>jeringen (T)</i>	jerrycan
<i>kantadeiro (T)</i>	raised bed often for growing seedlings
<i>karon (T)</i>	nylon sack e.g., 38kg rice sack
<i>katana ki'ik (T)</i>	small machete
<i>kaur (T)</i>	storage sack woven from palm leaf
<i>ke'e (T)</i>	to dig
<i>ko'a (T)</i>	to cut (e.g., harvesting rice)
<i>kulit (T)</i>	skin

<i>lere (T)</i>	to slash (e.g., weeds)
<i>lia nain (T)</i>	ritual elder and caretaker of ritual house
<i>linggis (T)</i>	crow bar
<i>lok malus (T)</i>	open a meeting with offering of areca nut (<i>bua</i>), betel leaf (<i>malus</i>) and lime powder (<i>ahu</i>)
<i>lona (T)</i>	tarpaulin on which garden produce is laid to dry in the sun
<i>lotuk (T)</i>	narrow
<i>lulik (T)</i>	sacred
<i>mamar (T)</i>	soft
<i>maho be'en (T)</i>	dew
<i>Maromak (T)</i>	(Christian) God
<i>Matebian (T)</i>	ancestor spirits
<i>midar(T)</i>	sweet
<i>morin (T)</i>	fragrant
<i>moruk (T)</i>	bitter
<i>natar (T)</i>	ricefield
<i>oratorio (T)</i>	Christian shrine
<i>ovrese (T)</i>	sacrificial object
<i>quintal (T)</i>	house garden
<i>rai nain (T)</i>	custodian spirits of a particular place
<i>rega (T)</i>	to hand water
<i>rahun (T)</i>	dense, refined texture
<i>saboko (T)</i>	woven bag made from sago leaf
<i>sana rai (T)</i>	clay cooking pot used for cooking ceremonial rice
<i>sasoru (T)</i>	gruel/porridge usually made from maize or rice
<i>servisu hamutuk (T)</i>	mutual labour exchange
<i>sosi (T)</i>	sharefarming
<i>ta'a (T)</i>	to hoe
<i>taha tur (T)</i>	sickle
<i>talin (T)</i>	maize tied as wreath
<i>tidin ai rin (T)</i>	flat wooden disk atop single vertical pole used for storing maize
<i>tilun (T)</i>	'ear' of digging stick often used to cover hole in which seed has been planted
<i>to'os (T)</i>	garden
<i>tunis (T)</i>	pigeon pea
<i>uma kain (T)</i>	nuclear household
<i>uma ki'ik oan (T)</i>	elevated small house used to store maize
<i>uma lisan (T)</i>	ritual household also referred to as ancestral origin house, core house or sacred lineage house
<i>xefe suco (T)</i>	village chief
<i>xefe aldeia (T)</i>	hamlet chief

BACKGROUND

In March 2006, a small socio-economic study (SOSEK) team was formed to carry out research in villages participating in the Seeds of Life (SoL) program. Over a twelve-month period, researchers collected data on cultivation techniques for maize, rice, sweet potato, cassava, peanuts and pigeon pea, providing a baseline study of techniques for the species being trialed by SoL. Data was also collected on how labour is organized for cultivating these species, highlighting the prevalence of mutual labour exchange, and the social networks in which farmer households are embedded. Allegiance to ritual houses comprises one such network, and the research reveals the continuing significance of the ritual house and ritual beliefs in relating to cultivating staple foods. The research results detailed in this report offer a social and cultural context to agricultural practice in Timor-Leste.

The SOSEK team comprises two socio-economics graduates from the University of Timor Leste (UNTL), Modesto Lopes and Anita Ximenes, and two anthropologists from the Research School of Pacific and Asian Studies at the Australian National University (ANU). Additionally, Marcellino de Jesus, a socio-economic graduate from UNTL and SoL staff member, joined the team for analysis of the longitudinal case study data. Dr Diana Glazebrook led the research from the SoL office in Dili, and Dr Andrew McWilliam based at ANU acted as research advisor. Other members of the research team included interpreters for Waimua and Makassae languages for Baucau district (Joao Manuel Correia Vital Ximenes and Manuel Calistro Ximenes) and Tokodede language for Liquica district (Bartolomeuw Da Silva).

Early in the program three principal methodologies were developed and trialed:

1. Agricultural calendars comprising interviews about SoL commodities with on-farm demonstration trial (OFDT) farmers to detail existing cultivation practices and map these against weather patterns in each of the sub-districts, as well as labour formations and religious rituals.
2. A 'baseline data' survey on the socio-economic conditions and characteristics of local farming production groups within the SoL program area to enable SOSEK to target particular farmer households for further research e.g., female-headed farming households, households with low ranking based on economic indicators.
3. Longitudinal case study comprising monthly visits to subsistence OFDT farmers to track food consumption and foraging strategies, as well as gifting, buying and selling, across the dry and wet seasons, and annual food shortage period before the maize harvest at the end of the wet season.

Agricultural calendar methodology

This report comprises data on cultivation techniques for the species being trialed by SoL, organization of labour for cultivating these species, and religious rituals associated with cultivating staple foods. In addition to this written report, the data mentioned is also represented in the format of agricultural calendars (posters).

Data was gathered between April 2006 and March 2007 in seventeen villages across eight sub-districts (see Table 1). Respondents in each district were identified to represent the variety of elevation (soil types, slope, orientation) in each district. For example, in Liquica district, agricultural calendar respondents are located at Daru Leten (1241 metres above sea level), Maubara lisa (998 metres), Dato (575 metres), Gugleur (Loes) (78 metres), and Vatuvou (4 metres). In rice-dominant areas, OFDT farmers for whom rice constituted their principal crop were selected. Five out of seventeen respondent households in this study were rice-dominant. Elevation was a key criteria as the the research sought to look broadly at the range of cultivation practices within the four districts of the study.

Table 1. List showing villages and hamlets where research was conducted

District	Sub-district	Village	Hamlet	Local language	Elevation	Agro-climatic zone classification ¹
Aileu	Aileu	Sarin	Malani	Mambae	935m	Northern upland
Aileu	Aileu	Seloi kraik	Lio	Mambae	1077m	Northern upland
Aileu	Aileu	Lausi	Fahi soi	Mambae	906m	Northern upland
Aileu	Leqidoe	Manucasa	02	Mambae	1363m	Northern upland
Manufahi	Same	Betano	Bematan	Mambae	2m	South coast lowland
Manufahi	Same	Lete foho	Ladiki	Mambae and Laklei ²	408m	Southern upland
Manufahi	Alas	Mahakidan	Debuwain	Tetun Terik	20m	South coast lowland
Manufahi	Alas	Dotik	Lakluan	Tetun Terik	20m	South coast lowland
Liquiza	Liquiza	Dato	Kamala hoho ru'u	Tokodede	34m	Northern coast lowland
Liquiza	Liquiza	Daru lete	Lebuae	Tokodede and Mambae	1241m	Northern upland
Liquiza	Maubara	Vatuvou	Vatunau	Tokodede	9m	Northern coast lowland
Liquiza	Maubara	Maubara lisa	Darulema	Tokodede	998m	Northern upland
Liquiza	Maubara	Gugleur (Loes)	Lebu-lugur	Tokodede	78m	North coast lowland
Baucau	Vemasse	Vemasse tasi	Welakama	Waimua	255m	Northern slopes
Baucau	Baucau	Gariwai	Dara sula	Makassae	680m	Northern upland
Baucau	Vemasse	Loilubo	Keitara nau	Waimua	770m	Northern upland
Baucau	Baucau	Buroma	One sere	Makassae	2m	North coast lowland
Baucau	Baucau	Sesal	Ague	Makassae	7m	North coast lowland

Respondents comprised OFDT participating farmers who were prominent ‘figures’ in their own communities, for example, village head (Tetum: *xefe suco*), hamlet head (Tetum: *xefe aldeia*), catechist, teacher, or elder presiding over ritual activity and customary law (Tetum: *lia nain*). Local figures were chosen as respondents with the rationale that their community activities would provide wider knowledge of local patterns of cultivation and production constraints. In the course of this research however it became clear that all OFDT farmers were members of mutual labour groups, and familiar with the practices and constraints of their fellow mutual labour group members. Conversely, the off-farm activity of community figures could effectively remove these individuals from farming activity to the extent that some did not participate as members of mutual labour groups.

Many interviews were not ‘one on one’, but included the respondent, adult members of their own household, extended family members living in households nearby, and neighbours. Interviews often resembled a focus group discussion with participants disputing, elaborating and clarifying each other’s responses. For example, in Letefoho (Manufahi district) a core group of about 10 adults – men and women of different age groups - attended every interview .

Interviewers visited respondents prior to each interview in order to arrange a suitable time, and according local custom, offered areca nut (*bua*), betel leaf (*malus*) and lime powder (*ahu*) in a woven basket (*mama fatin*) to respondents as a means of ‘opening’ each visit (Tetum: *lok mama* or *lok malus*).

¹ Source: ARPAPET (1996)

² A Laklei-speaking group of households now resident in Letefoho village in Same sub-district originally came from Turisca and relocated to Letefoho during the Indonesian period.

Table 2. List of respondents who participated in the study

District	Sub-district	Suco	Aldeia	Local language	Name of respondent	Rice-dominant or maize-dominant farmer household
Aileu	Aileu	Sarin	Malani	Mambae	Jacarias Mauzinho Gusmao	Rice
Aileu	Aileu	Seloi kraik	Lio	Mambae	Jose de Jesus	Rice
Aileu	Aileu	Lausi	Fahi soi	Mambae	Joao da Silva	Maize
Aileu	Leqidoe	Manucasa	02	Mambae	Jose Martins	Maize
Manufahi	Same	Betano	Bematan	Mambae	Augusto Pererara	Maize
Manufahi	Same	Lete foho	Ladiki	Mambae	Domingus Tilman; Evangelino de Andrade; Madalena da Costa	Maize
Manufahi	Alas	Mahakidan	Debuwain	Tetun Terik	Alberto da Costa; Emilio da Costa; Franco Juzinda da Costa	Maize
Manufahi	Alas	Dotik	Lakluan	Tetun Terik	Franco da Costa Duarte; Esteva Sarmento; Yumar Sarmento Fernandes	Maize
Liquiza	Liquiza	Dato	Kamala hoho ru'u	Tokodede	Natalia Pereira	Maize
Liquiza	Liquiza	Daru lete	Lebuae	Mambae/Tokodede	Napoliao Dos Santos	Maize
Liquiza	Maubara	Vatuvou	Vatunau	Tokodede	Leonito Da Costa	Maize
Liquiza	Maubara	Maubara lisa	Darulema	Tokodede	Jose Lino Nunes Karion	Maize
Liquiza	Maubara	Gugleur (Loes)	Lebu-lugur	Tokodede	Emiliana dos Santos	Maize
Baucau	Vemasse	Vemase tasi	Welakama	Waimua	Jose Antonio de Jesus	Rice
Baucau	Baucau	Gariwai	Dara sula	Makassae	Carlos da Costa Freitas	Maize
Baucau	Vemasse	Loilubo	Keitara nau	Waimua	Abilio Belo	Maize
Baucau	Baucau	Buroma	One sere	Makassae	Antonio da Costa	Rice
Baucau	Baucau	Sesal	Ague	Makassae	Luis Correia	Rice

On average, nine visits were made to each farmer household with interviews between 1.5 and 3 hours in length. Approximately 150 visits were made to farmer households across the eight sub-districts between April 2006 and March 2007. All agriculture commodity interviews forming the basis of this report were conducted by Anita Ximenes and Modesto Lopes in Tetum, with occasional assistance from local language interpreters in Baucau and Liquica districts. Feedback sessions were conducted after each fieldtrip to review interview practice, revise questions, and resolve problems. Field data was reviewed after each fieldtrip so that missing data or secondary questions could be incorporated into the subsequent visit. Raw field data was written up in Tetum.

The data represented in agricultural calendar format will comprise extension and planning tools for SoL researchers, MAFF field staff, and NGOs involved in agricultural extension work in Timor Leste. The posters allow users to immediately determine cultivation activities (for both first and second season planting), and associated weather patterns, for any of the research sites at any time during the calendar

year. While the arrival and end of the wet season can only be represented as static in a calendar format, data on planting signals have been incorporated into the calendar for each commodity in each place. Rather than being attached to calendrical time such as ‘the first week of November’ these signs are attached to dynamic weather events. For example, the signal for planting peanuts in Mahakidan (Manufahi district) is: ‘plant after heavy rain has fallen for three days and soaked the ground well’.

Two calendar sets have been produced. The first calendar set is a classic agriculture calendar showing the timing of all major cultivation activities (SoL commodities and other cash crops such as coffee or mung beans), and non-cultivation agricultural activities such as building fences, garden shelters, and mats for drying food, as well as timing of religious rituals associated with cultivation, for each of the 17 villages where research was conducted. The village is the ‘axis’ of this first type of calendar. The axis of the second calendar set is the commodity. The second calendar set is comparative and shows cultivation activities for a single commodity against time/weather for each village. For example, the maize calendar for Baucau district shows cultivation activity times for maize in the five villages where research was carried out: Loilubo (770m), Garuwai (680m), Vemasse Tasi (255m), Sesal (7m) and Buroma (2m).

Besides seed/cultivar variety characteristics, and the sequence of cultivation activities for each commodity, data were also gathered on the social networks through which agricultural activity is conducted. Data on the constitution of mutual labour exchange groups, and their practice and function reveal that farmer households are not isolated production and consumption units but rather, nodal points in a network of inter-relationships. The following section examines several key terms used in presentation of social data throughout this report: nucleated household, extended family, ritual house, mutual labour group, and religious rituals.

Explanation of terms

‘The household’ (Tetum: *uma kain*)

Across the four districts of study, the ‘household’ is a similar nucleated formation, in contrast to the extended family (Tetum: *familia*) which comprises several related households as described below.

Respondents defined household in social and/or spatial terms, with most defining households in social terms. A social definition refers to the relations between the people in that household, whereas a spatial definition refers to those people who share the same living space or share the same cooking hearth. In Timor, the cooking hearth is considered by some anthropologists to define the unit of the household. For example, married sons may live ‘under the same roof’ as their parents, but it is their establishment of a separate cooking hearth and food storage area within that house that determines their status as another household.

Most respondents explained that a household is formed when a man submits bridewealth to the family of his bride, and in doing so, becomes head of his household (Tetum: *xefe familia*). This practice is explained in Tetum as “*ema nebe hola malu ona*” meaning when the sides of the couple have compensated one another. In practice, this means the man’s family submit buffalo, goats, gold, money etc. to the side of the woman, and the woman’s side submits pigs and loom-woven tais to the side of the man. It is through marriage that a man becomes the head of a family comprising his wife and their children (Tetum: *fen, laen no oan sira*). In most general terms, a household is constituted in terms of two generations: husband and wife and their unmarried offspring (Tetum: *klosan*).

Respondents’ definition of ‘household’ may have been influenced by the Census definition that married offspring living with their parents constitute another household. For example, one respondent explained ‘household’ and then confirmed that his description was in keeping with the official Census definition that a married couple comprise a household.

Several variations exist:

- a 'household' may also include a man's sibling's sons or nephews (Tetum: *sobrinyo*)
- a married son and his wife who come to live with his parents in their house may be considered part of a single household (e.g., Vemasse Tasi, Loilubo, Mahakidan)
- a married son and his wife who come to live with his parents in their house are considered as a second household (Betano, Vatuvaio)
- the eldest unmarried son, who may be as young as 13 years, may assume the economic responsibilities of 'household head' in the event of the death of his father

Most commonly, in the context of division of labour, where a cultivation activity is said to be performed by members of one household, the members of this group comprise the head of the family and his wife, and their unmarried offspring. The household functions as a food production unit with all members of the family, including children, taking part in cultivation activities.

'The extended family' (Tetum: familia)

The extended family formation known as *familia* comprises a man and his wife, the wife's family (Tetum: *umane*), the man's male siblings and their families (Tetum: *maun/alin*), and sons-in-law (Tetum: *mane foun*). Members of the extended family live in nucleated households as described above.

In the context of division of labour, where an activity requires substantial labour inputs not available at the level of the nuclear household, for example, in the case of irrigated rice and maize, a farmer may be assisted by members of his extended family who live nearby.

'The ritual house' (Tetum: uma lisan)

Every rural household is affiliated to a ritual house (Tetum: *uma lisan*) variously described as a sacred house, ancestral origin house, core house or sacred lineage house. The ritual house comprises member households headed by men who are younger or elder siblings. As a group, member households share common ancestors, and common land to which they collectively claim (McWilliam 2005:32).

Certain religious rituals associated with agriculture involve households that are affiliated to the same ritual house. These larger-scale rituals are led by a ritual elder (Tetum: *lia nain*) who is the custodian of the ritual house, and whose knowledge about ritual ceremony and ritual objects is transmitted to subsequent ritual elders. Ritual houses and ritual elders are integral to the cultivation cycle of the staple foods maize and rice in particular, and to the harvest of all cultivated food in general.

Mutual labour exchange groups known as '*servisu hamutuk*' are used for agricultural activity as well as for the construction and repair of ritual houses (Tetum: *uma lisan*). In this latter context, the members of a mutual labour group comprise the membership of the ritual house.

'Mutual labour exchange' (Tetum: servisu hamutuk)

Data on mutual labour groups provide preliminary insights into labour demand and supply, as well as the social and economic relations between farmer households. Some broad patterns are worth highlighting. In most general terms, mutual labour groups are constituted according to two factors:

- extended family as described above, and
- neighbours (Tetum: *visinyu*) whose gardens are proximate and who may or may not comprise extended family members, and in the case of rice farmers, neighbours who also have ricefields.

In some cases a farmer wishing to form a mutual labour group may inform the local xefe aldeia who will notify other potentially interested farmers. Labour groups based on garden proximity involve participants who may or may not have family connections. As cultivation neighbours there are clear advantages in collaborating to complete cultivation tasks.

Mutual labour groups undertake labour intensive activities in large gardens that are beyond the labour availability of the household unit such as felling and burning tall trees in the process of ‘opening’ a new garden, or weeding maize. These activities have the highest labour requirement in the cultivation cycle. In this report, the duration of the activity undertaken by the mutual labour group was based on the respondent’s own calculation. Some estimated the duration of the activity in terms of the time taken to complete specific tasks in each member’s garden (e.g., one day only), while others made this calculation based on the total time taken to complete every member’s garden (e.g., 20 days).

Table 3. Terms for mutual labour group (servisu hamutuk) in local languages

District	Sub-district	Village	Local language	Servisu hamutuk in local language
Aileu	Aileu	Lausi	Mambae	Servis fut (fut: hamutuk)
	Aileu	Sarin	Mambae	Tak nama (tak: servisu, nama: to’os)
	Aileu	Seloi kraik	Mambae	Do nama fut (do: servisu)
	Liquidoe	Manucasa	Mambae	Tak nama
Baucau	Baucau	Garuwai	Makassae	Tafuli servisu (tafuli: hamutuk)
	Baucau	Sesal	Makassae	Tafuli servisu (tafuli: hamutuk)
	Vemasse	Loilubo	Waimua	Ani Ini
Liquica	Liquica	Daru Leten	Mambae	Slulu
	Liquica	Dato	Tokodede	Slulu
	Maubara	Gugleur	Tokodede	Servisu futu
	Maubara	Maubaralisa	Tokodede	Selo limo (selo: selu, limo: liman)
	Maubara	Vatunao	Tokodede	Slulu
Manufahi	Alas	Dotik	Tetun Terik	Harosan (harosan: troka liman)
	Alas	Mahakidan	Tetun Terik	Harosan
	Same	Betano	Mambae	Mululu
	Same	Letefoho	Laklei Mambae	Servisu amutu / hataka rai Mululu

Exchanging hands or rotational system

Mutual labour groups use different methods of reciprocity. Most groups use a system of exchange or rotation, where members offer labour to fellow members and receive labour in return. This system is known literally as ‘exchanging hands’ (Tetum: *troka liman*) or ‘assisting each other’ (Tetum: *ajuda malun*). In some places, members themselves bring raw or cooked food to contribute to the meal, and in other places the host farmer will provide cooked food to group members. A matter worthy of further research in relation to mutual labour exchange is the question of *how* the order of work in members’ gardens is arranged given that the last member to have their garden weeded is at a distinct disadvantage as the weed growth will have compromised the development of the crop. One hypothesis is that mutual labour group members arrange the order of weeding based on planting times. This means that early planted maize needs to be weeded early in the cycle before shifting to fields planted later.

Paying with money

If financially able, a farmer may pay others to undertake a particular cultivation activity either because of urgency related to weather (approaching rain), or because they are incapable physically of completing this task at the level of their own household. Illness or social obligations may also constrain their ability to undertake the task. This arrangement is referred to as ‘paying with money’ (Tetum: *selu kole ho osan*).

Paying with cooked meat

Another arrangement is referred to literally as ‘increasing the people’ (Tetum: *hasai ema*) or ‘slaughtering an animal’ (Tetum: *ohu animal*). In this context, farmers give their labour in exchange for a meal of cooked meat slaughtered by the host farmer. Farmers who pay others in cash or in kind (cooked meat) in exchange for labour may not have time themselves to participate as a member of a mutual labour group. They may also be using their enhanced economic capacity (either cash or livestock) to pay for external labour.

Sharecropping

A fourth system of mutual labour is based on sharecropping where labour is compensated by a share of the harvest. This system is known in Tetum as *sosi* and occurs in the context of both rice and garden cultivation. For example, a land-owning farmer and a buffalo owner may share resources to produce a rice crop and then divide the harvest. Alternatively, a rice farmer or maize farmer without seed may seek out a sharefarmer partner who has seed (e.g., Gugleur). For crops like maize, sharing of harvest is more likely to occur where a mutual labour group has participated in several activities related to that crop’s cultivation e.g., garden preparation and burning, planting, weeding, and harvesting. The maize offered may be of a certain type e.g., young maize only, mature maize only, or large or small cobs only. Further, the quantity of maize distributed may be measured. For example, members of a mutual labour group in Liquidoe (Aileu district) who participated in maize cultivation activities throughout the season were given one wreath (Tetum: *talim*) comprising ± 50 cobs per person. However, the use of mutual labour groups to harvest maize and the quantity of maize shared is dependent on the size of the harvest. A poor harvest might mean that only the household producers gather in the crop.

In Dotik (Manufahi), farmers invite others to provide assistance at the time of harvesting both maize or rice. Those assisting usually do not have their own gardens and are compensated with a share of the harvest. However, where extended family members (Tetum: *familia*) assist with the harvest, the farmer must give them a share of the harvest regardless of whether they have their own garden. This system was seen to be burdensome by the informant as the farmer could be left with a substantially reduced harvest for storage.

Division of labour according to ‘custom’

For all commodities there are patterns in relation to the way labour is organized either as mixed or gender-restricted household groups, and mixed or gender-restricted mutual labour groups. Gender-restricted groups, that is women only/men only groupings, have two possible formations. Groups may be composed of women primarily (Tetum: *‘liu liu feto mak halao’*), or may comprise women only (Tetum: *‘feto deit mak halao’*). In the former arrangement, if there is a labour shortage, men may help women undertake an activity which is considered to be primarily a women’s task. Where this happens it is the physical nature of the task and its labour intensity that governs who primarily does this task. For example, in Loilubo and Gugleur, men only prepare the bunds for irrigated rice because the task is considered too heavy for women, and in Selo Kraik men only thresh rice. In the latter example, it is believed that if women thresh rice the quantity of rice will decrease, or in other words, the rice will become less. In this final case only, it is the local belief system or custom (Tetum: *lisan*) which maps female or male qualities onto certain processes or objects that is at the root of the gender-restricted division of labour. While across all respondents for all commodities this is the sole example of labour being gender-restricted as a result of local custom, anecdotal evidence from other researchers suggests this requires further investigation.

'Religious rituals' (Tetum: *ceremonia lulik*) in the course of cultivation

Religious rituals are integral phases in the cultivation cycles for maize and rice (irrigated and upland). Rituals associated with peanut cultivation were recorded for respondents in Daru Leten (Liquica district) and Letefoho (Manufahi district) only. While no religious rituals associated specifically with sweet potato, cassava or pigeon pea were recorded, a ritual performed at the time of opening new gardens is commonplace.

Ritual management of crops involve a significant investment cost, including economic resources such as pigs, goats and chickens. Rituals typically involve making an offering or sacrifice (Tetum: *ovrese*), the content of which is prescribed depending on the ritual. Such objects include betel leaf (Tetum: *malus*) and areca nut (Tetum: *buu*), an egg and chicken, and/or slaughtered goat or pig or dog. Sacrifice of livestock several times in a cultivation cycle demonstrate the extent to which resources are expended to ensure the success of agriculture, and the uncertain environment in which farming is conducted.

Many rituals are held in the garden or ricefield, with objects of sacrifice laid on a broad rock considered to be sacred (Tetum: *fatuk belar*). The sacrificial act represents a form of exchange whereby the ritual elder calls on the protection of ancestor spirits (Tetum: *matebian*), custodian spirits of the land (Tetum: *rai nain*), and the Christian God (Tetum: *Maromak*), to protect and nurture the staple food crops. In return for the sacrificial food, the blessings of the spirit world are bestowed upon the living community. Rituals may be carried out by the male head of a single household, or by a ritual elder (Tetum: *lia nain*), for example, in the ritual to seek permission to consume the new maize harvest. In these larger-scale rituals, the participating group may comprise many households, or all member households of one ritual house.

Sacred or *lulik* beliefs that are not expressed or performed as rituals are found in Daru Leten (Liquica district) in relation to drying sweet potato, and Manucasa (Aileu district) in relation to weeding peanuts. Additionally, in many places, farmers practice certain prohibitions or taboo (Tetum: *bandu*) which prohibit consumption of ready-to-harvest commodities until a ceremony has been properly undertaken that seeks permission from the ancestor spirits. The term '*tara bandu*' mentions an object which is hung near a fruiting tree or garden to indicate custodianship of that resource e.g., a piece of rattan is tied around the trunk of a mango tree, or the banned items are hung from a t-shape (two uprights and a horizontal piece of bamboo). It is widely believed that people thieving the foods that are the subject of the taboo, will suffer accident, misfortune or illness.

Fallow periods in some places may also be related to *lulik* beliefs. For example, the respondent in Gugleur (Liquica district) claimed that at the time of the ritual performed by an elder to open a new garden, the farmer must request permission from the custodian spirit that dwells in the place of the new garden. Permission is sought to cultivate the spirit's dwelling place for a determined period of time - in Gugleur this period is 2-3 years. (The determination of this period of use gives rise to the question of whether it is rational, that is, whether the period of use coincides with the actual period of soil fertility/increase in weed burden.) After the pre-determined period, the farmer leaves this garden to open a new one, again using a ritual elder to seek permission from the custodian spirit to open the new garden for a determined period of time. The farmer may return to the old (fallowed) garden after 2-3 years, performing the same ritual to seek permission from the custodian spirit.

Spirits of the land or custodians of place are thought to dwell or frequent certain places. These can include large trees such as the banyan (Tetum: *ai hala*), natural springs and water sources as well as stones, clefts or caves and other distinctive topographic features in the landscape. The relationship between the spirit world and social life in East Timor remains a vital one requiring regular communication through ritual invocation and sacrifice. While the expression of these ritual practices varies across the region, the cultural ideas that inform them represent the common heritage of all ethno-linguistic communities. Most farmers in this study for example, perceived themselves as prohibited from undertaking certain activities in relation to maize and rice cultivation before performing the appropriate rituals. The successful conduct of the ritual cycle is perceived to help remove the risk of misfortune, crop failure or injury (e.g., felling trees

during garden cultivation), and provides comfort to many farming households against the vagaries of Timor's climate.

Data presented in this report reflects only an initial survey, and in-depth interviews with ritual elders would allow for more nuanced data about the performance of rituals and the cultural meanings of sacrifice objects.

COMMODITIES

Data for each of the SoL commodities (maize, rice, cassava, sweet potato, peanut and pigeon pea) are ordered into six sections below. Each section follows the same structure: planting times for both first and second season, sequence of activities associated with cultivation, religious rituals associated with cultivation, and labour formations in relation to cultivating that commodity. Each section concludes with characteristics of varieties.

1. Maize (Tetum: batar)

Of the main food crops cultivated in East Timor, maize is the dominant cereal grown in the uplands and it is estimated that around 80% of East Timor farmers grow some maize. There is no clear agricultural census data that defines the yield or production of maize at present but there have been number of estimates based on sample surveys. Table 7 provides some comparative data on recent estimates of maize yields in East Timor. The figures are consistent with pre-1999 Indonesian government estimates and reflect the anecdotal claims of low and unreliable yields under present conditions.

Table 4. Maize: estimates of yield and production in East Timor

Source	Estimated Area of measure	Estimated Yield tonnes per ha.
FAO/WFP 2003	44,400ha	1.3 (0.6-2.0 by district)
Timor Leste Suco Survey 2001	70,000ha	0.57
World Vision Maize farm survey 2002/2003	25 farms in 2 districts (Ailieu and Bobonaro, 5m * 5m plots.	1.5 (range from 0.3 to 3.2 t/ha

Most local maize is of the flint ‘quality’ with small rounded seeds, made entirely of hard starch. Although the embryo is small, it germinates quickly, especially in drought or high temperature stress. The length of growing season is also a key character in determining maize quality types. Short season maize (Tetum: *batar lais*) reaches maturity in 90 days. This is often planted near the house and is the first cereal to be harvested during the wet season. It is often roasted and eaten on the cob, especially by children (Williams 2003).

Full season maize normally takes approximately 50-60 days from planting to flowering and 110-120 days from planting to harvest (Williams 2003). This is generally known as large maize (Tetum: *batar bo’ot*) but covers an unknown range of local maize varieties. Shorter season varieties of maize (60-90 days) known (literally, ‘quick maize’ in Tetum) are also widely cultivated but no definitive surveys of varietal range have been undertaken. A number of modern maize varieties have also been introduced to East Timor over a long period of time and some are still cultivated. All maize in Timor has been introduced at some indeterminate period but had spread across Timor by the 18th century (Fox 2003). During Portuguese times, a maize variety named Angola was introduced, and some farmers in Los Palos, Baucau and Maubara reportedly still grow some varieties that they call Angola.

More recently the Indonesian Department of Agriculture introduced a number of modern varieties into East Timor during the 1980s. Two of these varieties are Kalinga and Arjuna. Some East Timorese farmers call these varieties ‘Hybrida’ but they are not hybrids and are in fact open pollinated varieties (OPV). OPVs breed true to type from year to year unlike hybrids, and therefore are appropriate for subsistence

farmers who do not purchase seed on an annual basis. Kalinga and Arjuna were bred using modified mass selection techniques for resistance to a major disease 'downy mildew' and for high yields. They were released in 1980 and 1985 (respectively) and have a yield potential of about 6 t/ha.

Arjuna and Kalinga are semi 'dent maize' varieties, so are quite different from the local flint maize varieties that most farmers grow. Recent research has documented differences between Arjuna and local maize in the effort required to pound the grain and percent fines produced once the grains are pound (Williams and Gutierrez 2004). Arjuna required more time and effort to pound and shatter the grain than the local variety. In testing with 3 groups of rural families, pounding Arjuna took 60-100% longer to pound than the local variety. This was confirmed in the laboratory, where the force to shatter Arjuna seed 45% higher (20 for local and 27 kg force for Arjuna) than that required to shatter the local variety (Rob Williams pers comm.). Arjuna also produced more fine material when pounded. When 50g of Arjuna was pounded for 10 minutes 37% of the original weight became fine material compared to 30% for the local varieties. The consequences of these differences in food preparation has not been fully assessed, but represent an important area for applied research to assess the prospects for variety adoption.

The inclusion of these improved varieties of maize within Timorese cropping systems and their generic classification as 'local varieties' means that there is a need more clearly define the category of 'local variety' in order to assess the relative advantages of the recommended new varieties and their prospects for adoption by farmer households. Towards this objective a program of local variety collection, seed identification, reproduction and genetic cleansing of the variety strains is planned under SoL2.

Storage of maize grain is another significant area of variation across Timor Leste. The choice of storage method reflects a combination of available resources and established cultural practices. A significant amount of maize is stored in the sheath as this provides some degree of protection to the cob acting as a physical barrier to the invading weevils. The sheath can contain 10-20 leaves surrounding the cob. Some varieties have sheaths that do not cover the tip of the corn cobs (such as Arjuna) allowing easy access for weevils to the cob. Different varieties have different levels of sheath protection and resultant weevil tolerance. Studies undertaken at UNTL demonstrated that while local varieties have a low loss rate, improved varieties have a greater loss (up to 30 per cent) due to weevil damage.

When maize is tied and bundled in the sheath, it is often stored in an elevated dry area to reduce rodent attack and minimise weevil damage. People make use of trees, elevated houses and storage spaces above the domestic hearth to try and protect the maize quality. Smoke from the hearth keeps the maize dry and deters weevil infestation. If the maize is threshed before storage, containers such as second hand fuel drums and jerry cans may be used to store the grain. This is the most common form of storage in Loes and also found in Covalima and Lautem. Storage of grain in sealed containers is a preferred method for maize, particularly for improved varieties.

Limited quantities of maize are marketed, usually following good seasons when a substantial surplus had been harvested. The majority of the maize harvest, however, is consumed by producers as a staple food and given the reported frequency of food shortages prior to the new harvest, it is likely that most farmer families do not produce sufficient quantities of maize to supply annual household requirements. The growing popularity of rice since the Indonesian period, and the continuing significance of tuber production contribute to variations in consumption patterns.

1.1 Planting times for maize

Table 5. Maize: planting times for first season (wet season planting), by village

District	Sub-district	Village	Elevation	Time of first season maize planting	Time of first season maize harvest
Aileu	Aileu	Lausi	906m	After rain has fallen, usually November 8-9 and above. If rain is early, November 3-4 after the Day of the Ancestors (November 2-3).	End of February until March
	Aileu	Sarin	935m	After rain has fallen for 3-4 days (usually end of October and into November)	March
	Aileu	Seloi kraik	1077m	After heavy rain has fallen for 2-3 days (usually in November after the Day of the Ancestors)	February and March
	Liquidoe	Manucasa	1363m	After heavy rain has fallen for one day (usually mid-October)	March
Baucau	Baucau	Garuwai	680m	After rain has fallen (usually November)	February
	Baucau	Sesal	7m	After rain has fallen for 2-3 days (usually mid-November until December)	April
	Vemasse	Loilubo	770m	After heavy rain has fallen for one day (usually November)	End of March until the middle of April
Liquica	Liquica	Daru Leten	1241m	Plant 1-2 weeks before the rain falls (end of October until November)	March
	Liquica	Dato	34m	November 3 and above	Mid-March
	Maubara	Gugleur	78m	After rain has fallen for 2-3 days and has soaked the ground (usually end of October until November)	Mid-April
	Maubara	Maubaralisa	998m	Plant 1-2 weeks before the rain falls (end of October until November)	End of April to May
	Maubara	Vatuvou	9m	After rain has fallen for 2-3 days, and after the Day of the Ancestors	March and April
Manufahi	Alas	Dotik	20m	End of October	End of December until January
	Alas	Mahakidan	20m	November until December	March
	Same	Letefoho	408m	October or the beginning of November	March until April

Across the four districts, farmers look for the same signal to plant maize: between 1-4 days of ground soaking, heavy rain. It is hoped that this rain indicates the arrival of the wet season, and that the rain will fall continuously. If the rain comes early, planting occurs in October (and sometimes September), if the rain comes late planting can take place in the month of December. However, it can be said that the planting of maize is generally done in the month of November when rain is expected. It is commonly the case in Timor that heavy early rains are not followed up and young seedlings may wither and die requiring a second and even third planting. Note that two upland locations in Liquica district (Daru lete and Maubaralisa) plant maize 1-2 weeks prior to rain. In 2006, two study respondents in Maubaralisa planted in late October, and although the seed germinated initially, it died as a result of no follow-up rain. These farmers requested replacement seed in mid-November. Generally farmers are constrained to planting with the rains as any delay results in significant weed growth in the cleared fields.

Table 6. Maize: planting times for second season, by village

District	Sub-district	Suco	Elevation	Time of second season planting	Time of second season harvest
Baucau	Vemassee	Loilubo	770m	July	November
Liquisa	Maubara	Gugleur	78m	March until April	August until September
Manufahi	Alas	Dotik	20m	May	July
	Alas	Mahakidan	20m	May	July until August
	Same	Betano	2m	May until June	August until September
	Same	Letefoho	408m	April until May	July until August

Six out of fourteen farmers plant a second season of maize later in the year. All have access to water for irrigation, or rely on rainfall. In the case of Loilubo (Baucau district), a spring allows some farmers to irrigate maize daily throughout the cultivation period. Farmers throughout Manufahi district on the south coast take advantage of a second period of seasonal rain, the so-called 'eastern rains (Indonesian: *hujan timur*) between April, May and June. The sub-district of Same at an altitude of >500m is classified as southern uplands and receives more than 2000mm of rain over a nine-month period, while the southern lowlands (including Betano, Dotik, Mahakidan) at <100 m receive <1500mm of rain over 7-8 months (Fox 2003). Second season planting of most commodities occurs in Gugleur village in the fertile Loes river area of Liquisa district. While farmers claim the second crop relies on dew for growth, water from dew is not sufficient to grow maize. Farmers in Gugleur may choose land for a second maize crop based on locations with good grass growth in other dry seasons, indicating use of water stored in the alluvial soils of the region, which are deeper than most other locations.

Table 7. Maize: signs for planting (first season)

District	Village	Elevation	Sign for planting maize
Aileu	Sarin	935.	Plant after heavy rain has fallen for 2-3 days
	Seloi kraik	1077m	Plant after rain has fallen for 2 days
	Lausi	906m	Plant after heavy rain has fallen for 1-2 days
	Manucasa	1363m	Plant after heavy rain has fallen for one full day
Manufahi	Betano	2m	Plant after heavy rain has fallen for one full day, saturating the soil
	Lete foho	408m	Plant after the rain has fallen for 3-4 days
	Mahakidan	20m	Plant after heavy rain has fallen for 3 days
	Dotik	20m	Plant after heavy rain has for 1 week
Liquica	Dato	34m	Plant after rain has fallen for 1-2 days, saturating the soil
	Daru leten	1241m	For a large garden, plant 1-2 weeks before the rain is predicted to fall, and for a small garden plant after the rain has fallen
	Vatuvou	9m	Plant after rain has fallen for 1-2 days
	Maubara lisa	998m	For a large garden, plant 1-2 weeks before the rain falls, and for a small garden plant after rain has fallen for 1-2 days
Baucau	Gugleur	78m	Plant after rain has fallen for 1-2 days
	Vemassee tasi	255m	Plant after rain has fallen for 3 days
	Gariwai	680m	Plant after heavy rain has fallen for one day accompanied by thunder
	Loilubo	770m	Plant after rain has fallen for 1-2 days
	Sesal	7m	Plant after heavy rain has fallen continuously for 1 full day

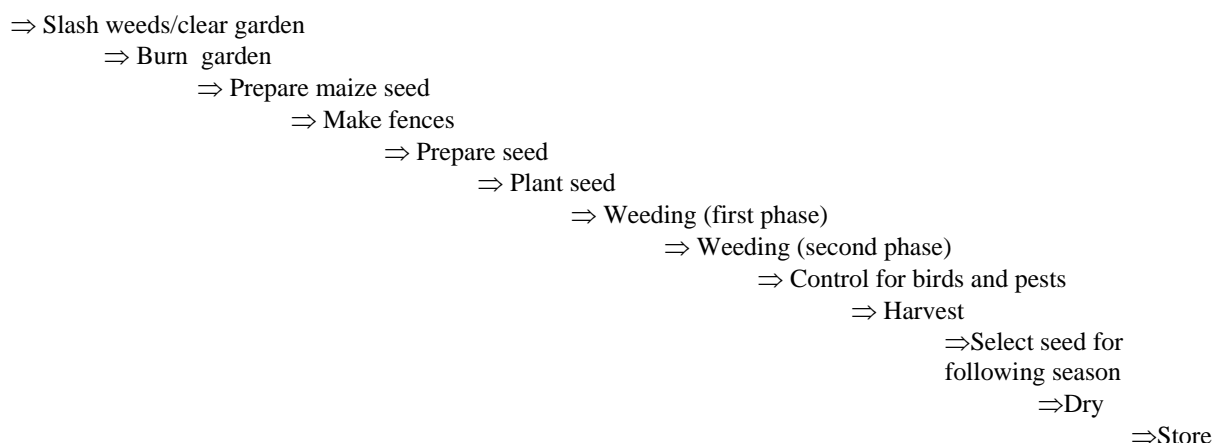
For first season planting of maize coinciding with the beginning of the wet season, nearly all farmers plant after rain has fallen. In two locations in this study however, both highland areas in Liquica district (Maubaralisa, 998m) and Darulete (1241 m), farmers who plant maize in large-scale gardens plant 1-2 weeks prior to rain. Large-scale planting of maize seed was carried out prior to rain because in the event of there being insufficient follow-up rain, the night time dew (Tetum: *maho be'en*) and very light rain (Tetum: *udan pisca*) in the mountains was claimed to be sufficient to wet the soil. A further reason was given that in the mountain areas, large-scale planting after rain had fallen was impracticable because continuous heavy rain characteristic of upland areas hindered planting. By way of contrast, the respondent in Manucasa village, Aileu district (1363m) planted maize after one full day's rain.

The planting of maize prior to rain is not common but deserves further attention, for example, to what extent planting is determined by specific dates, and methods deployed to stop rats from eating maize seed planted prior to rain.

1.2 Cultivating maize

Across all districts, the sequence of activities associated with maize cultivation follows a common general pattern.

Diagram 1. Sequence of maize cultivation activities



Garden preparation

Throughout Timor, land is prepared to make new gardens in the following sequence: grass and shrubs are slashed and tall trees felled and in some places burned. In some places the soil is tilled using a hoe (Tetum: *enxada*), and/or dug over with a digging stick made of steel or wood (Tetum: *ai besi/ai suak*). Wealthier households in lowland areas can plough with a tractor. In most places towards the end of the dry season, garden land is burned as close to the arrival of the wet season as possible in order to clear the fields of debris.

When opening a new garden, most respondents used a 'slash and burn' system: slash the grass, fell trees that grow inside the garden, spread out the felled trees to dry, then burn the felled trees. Farmers who reported using techniques of slash and burn were from from all districts and elevations (Manufahi district (Betano, Dotik, Maha kidan,), Liquica district (Daru leten, Vatuvou, Maubara lisa, Liquica) and Baucau district (Sesal)). In Letefoho (Manufahi), farmers slash and cultivate directly without burning.

Mutual labour groups are most commonly utilised for opening new gardens, although this depends on the field size, and in the case of rotational labour exchange, capacity of an individual farmer to contribute their labour in other members' gardens, or in the case of compensating labourers, capacity to slaughter an animal. If the fields are small, preparation is normally undertaken by household members only. A small

mutual labour group consists of 5-10 members (e.g., Sesal in Baucau district) while a large group can consist of 20-25 members (e.g., Gugleur in Liquica district). The activity of opening a new garden depends on the garden size but may take from 1 week to 1 month for a household group, and 1-2 days in each members' garden for mutual labour groups. Farmers categorized maize gardens in terms of small and large gardens, with the former being less than half a hectare and the latter being about a hectare, although some respondents claimed a two hectare garden was large. Any data on garden size should not rely on farmers' estimates of a single measurement but should be correlated with additional measurements such as quantity of maize seed planted or size of average yield.

Fallowing

Most respondents fallow their maize garden with the average period of cropping being 2-3 years, and the period of fallowing that garden also 2-3 years. Some farmers only fallow a garden where maize is planted if the soil loses fertility and yield declines, and some farmers may only re-plant a fallowed garden when it is considered to be fertile (Tetum: *bokur*) again. In upland areas (e.g., Maubaralisa) where cassava is planted with maize, maize is planted in a new garden annually to avoid disturbing the slow-developing cassava during garden preparation. Some farmers do not fallow at all (e.g., Lausi, Garuwai, Vemasse Tasi), and others only fallow if they have an alternative garden area to shift to. There is a tendency for coastal area gardens to be fallowed for longer periods (e.g., 4-6 years), while mountain regions fallow for periods of 2-3 years on average. While weeds and weed burdens were not mentioned by respondents in this study, other studies have reported farmers as saying that it is easier to clear forest than to weed an old garden.

Table 8. Maize: fallow times for gardens

Village	Elevation	Length of time maize planted before garden left to fallow	Length of time garden left to fallow before opened again
Sarin	935m	2-3 years	2-3 years
Seloi kraik	1077m	Depends on the condition of the soil, whether still fertile (Tetum: <i>buras</i>) or not	2-4 years
Lausi	906m	Maize gardens are not fallowed	n/a
Manucasa	1363m	Depends on the condition of the soil, whether still fertile or not	Can only return to plant in this garden when the soil is fertile (Tetum: <i>bokur</i>) again
Betano	2m	3 years	5-6 years
Lete foho	408m	Depends on the condition of the soil, whether fertility has decreased or not	3 years
Mahakidan	20m	3 years	2-3 years
Dotik	20m	Depends if there is other available land to open a new garden when the old garden's soil fertility has decreased	1-2 years
Dato	34m	1-2 years	4-5 years
Daru leten	1241m	2 years but depends whether other land available	1-2 years
Vatuvou	9m	Depends on the condition of the soil, whether fertility has decreased or not	1-2 years
Maubara lisa	998m	1 year if planted with cassava as cassava takes 2-3 years til harvest, preventing easy preparation for planting maize again	2 years
Gugleur (loes)	78m	3 years	2-3 years
Vemase tasi	255m	Maize gardens are not fallowed	n/a
Gariwai	680m	Maize gardens are not fallowed	n/a

Loilubo	770m	2 years for land that has never previously been planted by the farmer ³	3-4 years
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Selecting maize seed for planting

The pattern for selecting maize seed for planting was uniform across districts: kernels from both ends of the cob are removed and discarded, and kernels from the middle of the cob are selected for the following characteristics: fat, flat, clean and with a sculletum (Tetum: *aten*) that is not black. In one field site only (Betano, Manufahi district), the respondent soaked maize seed in water, discarded floating seed, and used the remainder as seed for planting. This process indicates that soaking may function as a test for good seed as well as pre-soaking preparation prior to planting. Women and girls undertook the activity of selecting maize seed for planting in 80% of households interviewed, with mixed household groups making up the remainder. Nearly all respondents selected suitable seed for planting, or suitable cobs from which to select seed for planting, at the time of harvest. A couple of respondents only (Betano and Loilubo) did not select seed until just prior to planting. Suitable seed or cobs were kept separate from maize for consumption, but tended to be stored in the same place, usually the kitchen hearth. All respondents smoke-dried maize seed for planting.

Table 9. Maize: selection and storage of seed for planting, by village

Village	Timing of selection of seed for planting	Storage of maize seed selected for planting
Sarin	Select directly after harvest	Smoke-dry above kitchen hearth or sun-dry from tree
Seloi kraik	Select directly after harvest	Smoke-dry above kitchen hearth or sun-dry from tree
Lausi	Select directly after harvest	Smoke-dry above kitchen hearth or sun-dry from tree
Manucasa	Select directly after harvest i.e., at the time of tying cobs	Smoke-dry above kitchen hearth or sun-dry from tree
Betano	Select and separate suitable seed just before planting	Stack on disk above a pole
Lete foho	Select suitable large cobs directly after harvest	Store high above kitchen hearth
Mahakidan	Select suitable large cobs directly after harvest	Smoke-dry above kitchen hearth
Dotik	Select suitable large cobs directly after harvest	Store high above kitchen heart
Dato	Select suitable cobs for seed directly after harvest, then tie and keep separate	Smoke above the kitchen hearth, and keep stored there
Daru leten	Select suitable cobs for seed directly after harvest, then tie and keep separate	Smoke above the kitchen hearth, and then dry in a secure place such as inside a drum or in elevated structure (Tetum: <i>uma ki'ik oan</i>)
Vatuvou	Select suitable for seed directly after harvest, should be large and suitable for tying	Smoke above the kitchen hearth, and keep stored there
Maubara lisa	Select suitable cob directly after harvest, then keep separate	Smoke above the hearth
Gugleur (loes)	Select suitable cob directly after harvest, then keep separate	Store in elevated platform outside then smoke using fire beneath the platform
Vemase tasi	Select suitable cob directly after harvest	Suspend above the kitchen hearth
Gariwai	Select suitable cob directly after harvest	Smoke above the kitchen hearth
Loilubo	Select suitable seed just before	Store above the kitchen hearth with maize for eating

³ In Tetum, the distinction is made between 'old land' which has never been cultivated (Tetum: *rai tuan*) and fallowed gardening land, literally 'old gardens' (Tetum: *to'os tuan*).

	planting	
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Planting maize

Before planting maize, some farmers make a sacrifice (areca nut, betel leaf, egg, chicken) to invoke the power of the ancestors and God to protect the maize seed from animals and pests.

Farmers plant an average of 2 to 4 maize seeds in holes formed with a planting stick which can be made from wood or steel (Tetum: *ai suak*) or a crowbar made of steel (Tetum: *linggis*). The pattern of planting showed farmers in Aileu plant 2-3 seeds, while farmers in Baucau planted 3-4. Farmers in Manufahi and Liquica planted either 2-3 or 3-4 indicating no pattern in relation to elevation. Planting distances differed. Farmers tended to plant maize using a stride for measuring between plants, and use a metal or wooden digging stick to make the hole. One respondent only (Sarin in Aileu district) planted maize in a line formation. Farmers close the hole in which they have planted the maize seed with either a digging stick or with their foot. The table below shows planting distances for maize, by village. Note that a meter ruler was used as a reference measurement by respondents.

Table 10. Maize: planting distances and closing planting hole

Village	Planting distance	Method for closing planting hole
Sarin	50cm	Tapered end of a digging stick, or foot
Seloi kraik	80cm	Tapered end of digging stick or foot
Lausi	70-90cm	Tapered end of digging stick
Manucasa	70-80cm	Tapered end of digging stick
Betano	70cm-75cm	Foot
Lete foho	70cm-80cm	Tapered end of digging stick or foot
Mahakidan	80cm	Foot
Dotik	Missing data	Tapered end of digging stick or foot
Dato	85cm-1m	Foot
Daru leten	50cm	Foot
Vatuvou	Missing data	Tapered end of digging stick
Maubara lisa	80cm-1m	Foot or digging stick
Gugleur (loes)	50cm-1m	Foot
Vemase tasi	80cm	Foot or digging stick
Gariwai	75cm-90cm	Foot
Loilubo	60cm-80cm	Foot
Sesal	25cm-50cm	Foot

Most farmers interviewed plant other food varieties in the same hole, most commonly, long bean (12 out of 16 farmers), pigeon pea (5/16), pumpkin (2/16) and white bean (1/16). Long bean (Tetum: *fore tali*) is a climbing bean that is planted with maize seeds as it utilises the rigid maize stem after harvest as a trellis. One respondent (Betano, Manufahi district) mentioned that long beans planted with maize in the second (dry) season are more productive than first season planting as they can be harvested until the stem has withered or dried. Pigeon pea is said to produce greater yields in the second season planting than in the first (wet) season. Pigeon pea (Tetum: *tunis*) is the second most popular species (Lausi, Gugleur, Maubaralisa, Letefoho) planted in the same hole as maize. It is claimed that pigeon pea reduces weeds, and its dried leaf matter is a useful fuel for burning off. Pumpkin was planted with maize by two respondents from Liquisa district. White bean was planted by one respondent for the same reason as long bean: the maize stem serves as a trellis.

In terms of crops planted in the same garden as maize, the respondent in Maubaralisa preferred not to plant cassava in the same garden as maize for two reasons: cassava tubers attract rats which then eat the

maize, and burning the garden prior to planting maize risks damaging cassava which grows slowly at high altitudes and can otherwise remain productive in the garden for several years.

Table 11. Maize: mixed planting practices by village

District	Sub-district	Village	Elevation	Other crops planted in the same hole with maize	Other crops planted in the same garden with maize
Aileu	Aileu	Lausi	906m	Long bean or pigeon pea	Peanut, bean, cucumber, pumpkin, cassava, sweet potato, orange, jackfruit
	Aileu	Sarin	935m	White bean	Cucumber, pumpkin, cassava, sweet potato
	Aileu	Seloi kraik	1077m	Long bean	Arrowroot, pawpaw, chilli, pineapple, banana, egg plant
	Liquidoe	Manucasa	1363m	Long bean	Peanut, soy bean, cucumber, pumpkin, cassava, sweet potato
Baucau	Baucau	Garuwai	680m	Long bean	Cassava, sweet potato, pawpaw, taro, arrowroot, orange
	Baucau	Sesal	7m	None	Large garden: Pumpkin House garden: Cassava, taro, sweet potato, pumpkin
	Vemasse	Loilubo	770m	None	Taro, cassava, pigeon pea, sweet potato, pumpkin, cucumber, yam bean, arrow root
Liquica	Liquica	Daru Leten	1241m	Long bean (in the house garden only)	Long bean, pigeon pea, red bean, pumpkin, cucumber, cassava
	Liquica	Dato	34m	None	None
	Maubara	Gugleur	78m	Long bean or Pumpkin or pigeon pea	Pigeon pea, pumpkin, cucumber, cassava, sweet potato, mango, jackfruit
	Maubara	Maubaralisa	998m	Long bean or pigeon pea	Large garden: Pigeon pea, pumpkin, peanut House garden: Long bean, pigeon pea, cassava, sweet potato (small quantity will not attract rats)
	Maubara	Vatuvao	9m	Long bean or pumpkin or pigeon pea	Long bean, pumpkin
Manufahi	Alas	Dotik	20m	Long bean	Dry area: Banana, taro, cassava, sweet potato, pawpaw, pumpkin. Wet area: Long bean
	Alas	Mahakidan	20m	Long bean	Cassava, sweet potato, taro, arrowroot, pigeon pea
	Same	Betano	2m	Long bean	Long bean, soy bean, sweet potato, cassava
	Same	Letefoho	408m	Long bean or pigeon pea	Taro, banana, cassava, sweet potato, pigeon pea

Weeding maize

Farmers weed maize twice on average prior to harvest. Because maize is grown with other commodities in the same garden such as peanuts, sweet potato, and cassava, weeding maize is not undertaken in isolation. Rather, two to four weeks after planting maize seed, household or mutual labour groups weed the maize and all other commodities in the garden, and four weeks after this first weeding the garden will be weeded again. Farmers use either mutual labour groups or mixed household groups for the first weeding (on average about 8-10 people), and usually household groups for second and subsequent weedings (on average about 4-5 people). The first weeding activity takes place two to four weeks after planting (although in Daru leten when the maize produces four leaves this is the sign for weeding to commence). On average, a second weeding is carried out four weeks after the first weeding. The number of times

weeding is undertaken depends on the age of the garden: older gardens require as many as three weeding whereas a new garden may require one weeding only.

Table 12. Maize: weeding activities by village

District	Suco	Elevation	Total number of weeding activities for maize	Number of people for first weeding	Number of people for second weeding
Aileu	Lausi	906m	Twice	8-15	5-8
	Sarin	935m	Once	4-5	No second weeding
	Seloi kraik	1077m	Once for maize-only garden Twice for mixed garden	4 people for maize-only garden 5-10 for mixed garden	2
	Manucasa	1363m	Twice	6-10	4-5
Baucau	Garuwai	680m	Twice	3-5	1-2
	Loilubo	770m	Once	6-10	No second weeding
Liquica	Daru Leten	1241m	Twice	4-10	5-7
	Dato	34m	Twice	4-6	2-3
	Gugleur	78m	Twice	8-10	4-5
	Maubaralisa	998m	Twice	10-20	4-5
	Vatuvao	9m	Twice	5-10	5-10
	Dotik	20m	Twice	5-10	5-10
	Mahakidan	20m	Twice	5-10	5-10 (depends on garden size and weeds present)
	Betano	2m	Twice	7-8	7-8
	Letefoho	408m	Twice	7-8	2-3 (farmer only)

The length of time taken to weed maize depends on garden size, and the number of members of the mutual labour group or household. On average it takes between one to two days to weed maize in any one garden. In some places, weeds are heaped up around the base of the maize plant so that it will decompose and minimise new weed growth. For digging weeds, either metal or wooden digging sticks (Tetum: *ai suak*) are used, for slashing weeds a small machete (Tetum: *katana ki'ik*) or sickle (Tetum: *taha tur*) are used, and a hoe (Tetum: *enxada*) is used for hoeing weeds. Weeding actions include: digging (Tetum: *ke'e*), pulling out (Tetum: *fokit*), slashing (Tetum: *lere*), and hoeing (Tetum: *ta'a*).

By using mutual labour groups, each member's garden can be weeded in a one to two day block, depending on the size of the garden. Taking Liquica district as an example, the average number of members involved in a mutual labour group in a coastal area (e.g., Maubara, Gugleur) is about 7-12, whereas the group can be as numerous as 20-25 in mountain areas like Maubaralisa. This was different in Mahakidan where farmers were assisted by one or two others only to weed their garden on a daily basis until the maize had developed cobs.

Table 13. Maize: division of labour for weeding by village

District	Sub-district	Suco	Labour formation for first weeding activity	Process of weeding
Aileu	Aileu	Lausi	Mutual labour group or household	Dig, pull out, then hoe
	Aileu	Sarin	Mutual labour group or household	Dig, pull out, then slash
	Aileu	Seloi kraik	Mutual labour group	Dig then pull out
	Liquidoe	Manucasa	Mutual labour group	Dig then pull out
Baucau	Baucau	Garuwai	Household, predominantly men	Dig, pull out, then hoe
	Baucau	Sesal	Household, mixed	Dig then pull out
	Vemasse	Loilubo	Mutual labour group or household	Dig, pull out then hoe
Liquica	Liquica	Daru Leten	Mutual labour group or household	Dig then pull out, then hoe
	Liquica	Dato	Household, mixed	Dig then pull out, then slash
	Maubara	Gugleur	Mutual labour group	Slash
	Maubara	Maubaralisa	Mutual labour group or household	Pull out then slash
	Maubara	Vatuvao	Household, mixed	Pull out then slash
	Manufahi	Alas	Dotik	Mutual labour group
Alas		Mahakidan	Household, predominantly men	Dig, pull out then slash
Same		Betano	Household	Dig then hoe
Same		Letefoho	Mutual labour group	Dig, pull out, then hoe

Harvesting maize

On average, long season maize (Tetum: *batar bo'ot*) is harvested between March and May and takes 3 to 4 months between planting and harvest. Short season maize (Tetum: *batar lais*) is harvested between January and March depending on planting times and takes between 1.5 and 3 months to harvest. Short season maize is harvested by household members only, while long season maize may be harvested by a household group, or a mutual labour group. Among respondents surveyed in Manufahi, Liquica and Baucau districts, the harvesting of maize is either immediately preceded by, or immediately followed by, a religious ritual where either goat or pig or chicken is sacrificed to the ancestors to symbolize their gratitude for the harvest. Harvesting and/or consumption of long season maize is prohibited until this ritual has been undertaken.

Short season maize does not require performance of a religious ritual prior to consumption. As a sort of bridging food, *batar lais* is said to be grown for children to satisfy their hunger while waiting for the main long-season maize crop. Short-season maize is not cultivated with the aim of storing as a reserve food during the dry season. It can be surmised that because farmers do not depend on a large harvest of this maize to keep as a food reserve throughout the rest of the year, there is no formalized expression of gratitude to the ancestors for a successful harvest of short-season maize. One respondent (Daru Lete) planted long and short season maize in separate plots within his garden so that his children could not accidentally pick and eat long-season maize while harvesting short-season maize.

Drying and storing maize

Maize is dried using either the heat of the sun or fire (smoking). Maize may be smoked by placing on a shelf above an existing open hearth inside a kitchen, or on a platform built over a fire place outside. Smoking times vary from 2-3 days to 2-4 weeks. Maize which is dried in the sun may be hung in a tall tree.

- Dry (smoke) maize above a shelf over the hearth in the kitchen: Aileu district (Manucasa, Selo kraik), Manufahi district (Letefoho, Dotik), and Liquica district (Maubaralisa)
- Sun-dry maize outside: Aileu district (Lausi) and Liquica district (Gugleur)
- Dry maize inside if wet/overcast or dry maize outside if full sun: Aileu (Sarin), Liquica (Vatunao, Daru lete, Dato) and Baucau (Garuwai)

The length of time for drying in full sun or smoking inside varies. Liquica district provides an example. In coastal Vatuvou (9m), farmers store maize for eating, and seed for planting, above the fire place until planting time the following year. Whereas in upland Maubaralisa (998m), the respondent dried maize above the fire place for 2-4 weeks only, and then transferred maize to an elevated platform with a roof referred to in Tetum as '*uma ki'ik oan*', literally, small house.

Maize may be stored as intact cobs in the sheath, as a full cob with sheath removed, or as kernels that have been removed from the cob. Kernels may be separated from the cob using one's fingernail, and/or the full cob placed in a sack and beaten with a piece of wood to separate the kernels from the cob. Maize that has been removed from the sheath is usually dried first, and then the kernels are removed and stored inside a drum, or a bag kept on a shelf above the hearth in the kitchen. All respondents either tied maize sheaths into a wreath by means of knotting the sheath (Tetum: *kesi*), or tucked/slipped the maize stem (Tetum: *taang*) to form a wreath for those varieties without a long enough sheath for knotting (see table 14 below).

Table 14. Maize: wreath types in local language

Village	Local language	Maize wreath made from knotted sheath (Tetum: <i>kesi</i>)	Maize wreath made from tucked stem (Tetum: <i>ta'an</i>)
Sarin	Mambae	Tluh batar (Tluh=to tie, batar=maize)	As-tan (As=sikat, tan=tuck)
Selo kraik	Mambae	Buk sela (Buk=to tie, sela=maize)	As- tan
Lausi	Mambae	Eis batar (Eis=to tie, batar=maize)	As-tan
Manucasa	Mambae	Eis batar (Eis=to tie, batar=maize)	Hid batar (Hid=tuck)
Betano	Mambae	Eis batar (Eis=to tie, batar=maize)	Astao (Astao=tuck)
Lete foho	Mambae	Eis batar (Eis=to tie, batar=maize)	Tao
Letefoho	Laklei	Esi batar	Aisaka (Aisaka=tuck)
Mahakidan	Tetun Terik	Sohen (Sohen=tie)	Sakan (sakan=tuck)
Dotik	Tetun Terik	Sohe batar (sohe=tie)	Sakan batar
Dato	Tokodede	Tohoku (Tohoku=to tie)	Astou
Daru leten	Tokodede Mambae	Tluh	Tara (Tara=tuck)
Vatuvou	Tokodede	Tohoku (Tohoku=to tie)	Astou (Astou=to tie)
Maubara lisa	Tokodede	Tohoku	Astou

		(Tohoku=to tie)	(Astou=to tie)
Gugleur (loes)	Tokodede	Towo uku sele (Towo=twine, uku=maize sheath, sele=maize)	Ta'a sele
Vemase tasi	Waimua	Nuku kera (Nuku=to tie, kera=maize)	Sabaran (sabaran=to tuck)
Gariwai	Makassae	Teli gu'u (Teli=maize, gu'u=to tie)	Teli sabar
Loilubo	Waimua	Hui kera (Hui=to tie, kera=maize)	Khaki kera (Khaki=to join, kera=maize)
Buroma	Makassae	Teli gu'u (Teli=maize, gu'u=to tie)	Teli sabar

Several places or receptacles are used to store maize including: the shelf above the hearth (Tetum: *ai leten*); in an elevated structure next to the main house (Tetum: *uma ki'ik oan*); stacked on a wooden disc above a pole (Tetum: *tidin ai ri'in*); suspended from a frame made of two vertical uprights and one horizontal pole (Tetum: *ai ri'in tara*); suspended from a tall tree near the main house (Tetum: *ai hun bo'ot nia leten*); or stored in a jerry can (Tetum: *jerigen*), or 200 litre drum.

The most popular method for storing maize was to stack on a shelf or frame above the hearth in the kitchen (100%), followed by stacking in an elevated structure near the main house (82%), hang from a frame (41%), hang from a tall tree (23%), and stacking on a disc above a pole (12%). This final method was found in Mahakidan and Lausi only. There is some correlation between place and method:

- Respondents in Aileu preferred to suspend maize from a tall tree
- Respondents from Liquica clearly preferred storing maize in an elevated structure outside the house, and storage above the kitchen hearth
- Respondents from Baucau preferred storing maize in an elevated structure or hanged from a frame
- Respondents from Manufahi preferred storing maize in an elevated structure and hanged from a frame

Table 15. Maize: storage methods for cobs in the sheath, by village

Village	Above the hearth in the kitchen (Tetum: <i>ahi leten</i>)	Hung from frame (Tetum: <i>tara iha ai rin</i>)	Hung from tall tree (Tetum: <i>tara iha ai hun bo'ot</i>)	Stacked onto a disc above a pole (Tetum : <i>tau iha ai rin leten</i>)	Elevated structure near main house (Tetum : <i>uma ki'ik oan</i>)
Sarin	Yes	No	Yes	No	Yes
Seloi kraik	Yes	No	Yes	No	No
Lausi	Yes	No	Yes	Yes	No
Manucasa	Yes	Yes	Yes	No	No
Betano	Yes	Yes	Yes	No	Yes
Lete foho	Yes	Yes	Yes	No	Yes
Mahakidan	Yes	Yes	Yes	Yes	Yes
Dotik	Yes	No	No	No	Yes
Dato	Yes	No	Yes	No	Yes
Daru leten	Yes	No	Yes	No	Yes
Vatuvou	Yes	No	Yes	No	Yes
Maubara lisa	Yes	No	No	No	Yes
Gugleur (loes)	Yes	No	Yes	No	Yes
Vemase tasi	Yes	Yes	Yes	No	Yes
Gariwai	Yes	Yes	No	No	No
Loilubo	Yes	Yes	Yes	No	No
Buroma	Yes	No	No	No	No

1.3 Religious ritual associated with cultivating maize

For most of the farmers in this study, religious rituals (Tetum: *ceremonia lulik*) are integral to the maize cultivation cycle. Religious rituals were not held in the following research sites : Aileu (Lausi) and Baucau (Vemase tasi, Buroma).

Rituals typically involve making an offering or sacrifice (Tetum: *ovrese*), and the form depends on the ritual. Such objects include betel leaf and areca nut, an egg and chicken, and/or slaughtered goat, pig or dog.⁴ The sacrifice functions to invoke or call upon the protection of the ancestors and God for an abundant crop. Most farmers in this study perceived themselves as constrained from undertaking certain activities in relation to maize cultivation (preparing a new garden, planting maize seed, harvesting maize, consuming maize) before the appropriate rituals and procedures had been performed. Performing the ritual lifts the prohibition, removing the risk of misfortune such as crop failure or injury.

The data on sacred rituals for maize cultivation was gathered through a preliminary survey (see table 16). Some patterns can be elaborated however. Most respondents carried out the harvest ceremony which offers thanks to the ancestors or the spirit custodian of that place (Tetum: *rai nain*) for the new harvest, and seeks permission to eat the new maize. The prohibition on maize consumption is lifted in this ceremony by the local ritual elder or ritual custodian (Tetum: *lia nain*). Other rituals are held at the time of garden preparation (to invoke the ancestors' protection against accident e.g., during felling tall trees or slashing long grass), at the time of planting maize seed (to invoke the ancestors' protection against weather events such as fierce winds, or pests or animals destroying the seed), and at the time of maize flowering (to invoke the ancestors' protection of the maize to bring a good harvest with large cobs).

Note, that in Mahakidan before eating the new maize, seven cobs of maize are taken either to the customary ritual house (Tetum: *uma lisan*), or laid before a Christian shrine (Tetum: *oratorio*) comprising a statue or poster of Mary, or statue of Jesus. In Betano, the respondent claimed that some maize-growing households no longer carry out religious rituals in relation to maize.

A pattern can be discerned in relation to the type of ritual, and who leads and attends that ritual (see table 17). In nearly all places, the ritual held after the harvest and prior to consuming the new maize is carried out by a ritual elder in the ritual house, and all member households of that ritual house attend. However, all other rituals are carried out by either the head of household or a ritual elder, and a limited number of households are invited such as neighbours whose gardens are proximate, and those people who assisted plant the maize. This is particularly striking for Vatuvaio in Liquisa district where according to the respondent, all maize rituals are held on a large scale with between 20 and 70 households taking part.

⁴ Based on data gathered from respondents in this study, some Mambae speakers may sacrifice dog at the time of maize harvest where other meat such as chicken or goat is unavailable. The liver, heart and tongue are the subject of ritual then these parts and the remainder of the dog is shared and eaten. In the case of coffee production, dog is preferred for sacrifice during rituals associated with weeding and harvest, and prepared and distributed in the same manner as described for maize above.

Table 16. Maize: religious rituals associated with cultivation, by village

Location	language	Type of ritual	Name of ritual in local language	Timing of ritual	Object of sacrifice	Objective of ritual
Manucasa (Aileu)	Mambae	1. Prior to consumption of new maize	1. Cermonia oid mu batar (Oid=for, mu=eating)	1. Prior to consumption of new maize	Pig, chicken, goat	1. In order to begin consumption of new maize
Sarin (Aileu)	Mambae	1. Post-harvest/pre-consumption ritual 2. Missing data	1. Cermonia sau batar (sau='halo tuir' in Tetun, meaning 'to follow' [i.e., in the ritual way of the ancestors]) 2. Cermonia Sbar ai (sbar=to broadcast, ai=plants)	1. After the harvest, before consumption of new maize 2. When the new year and the old year divide from each other ⁵	1. Pig, goat, chicken 2. Pig, goat, chicken	1. Seek permission to consume the new maize 2. To protect all plants in the garden from pestilence and disaster
Seloi kraik (Aileu)	Mambae	1. Pre-planting ritual 2. Pre-harvest/pre-consumption ritual	1. Cermonia naha kru sela (naha=will, kru=plant, sela=maize) 2. Cermonia fun tuir la seuf sela (fun=to do, tuir=join, la seuf=?, sela=maize) [i.e., to follow in the ritual way of the ancestors]	1. Prior to planting 2. Prior to harvest	1. Chicken or egg for small garden, dog or pig for large garden 2. Pig, dog, chicken	1. We must follow the ritual. [according custom]. So that ants do not damage the seed, and to get a good yield. 2. To seek permission to consume the new maize
Betano (Manufahi)	Mambae	1. Pre-maize planting ritual 2. Maize flowering ritual 3. Pre-harvest/pre-consumption ritual	1. Cermonia hrua batar (hrua=to plant, batar=maize) 2. Cermonia leus batar dikin (leus=remove, dikin=leaves/sheath) [In this ritual, some sheaths from damaged maize are removed with the objective that the harvest will produce healthy cobs] 3. Cermonia agradece la luli seira nor maromak (agradece=give thanks, la luli =to the sacred, seira=they, Maromak=[Christian] God)	1. Prior to planting maize 2. At the time of maize flowering 3. Prior to harvest	1. Betel leaf, betel nut, eggs and chicken, or goat or pig or dog. 2. Eggs and chicken, or goat or pig and dog. 3. Eggs and chicken	1. To ask the spirit custodian (<i>rai nain</i>) to help with seed germination and growth, and produce a good yield 2. To help maize grow well and produce good cobs 3. To give thanks for the harvest
Dotik (Manufahi)	Tetun Terik	1. Pre-harvest ritual 2. Post-harvest/pre-consumption ritual	1. Hasai ai dakar (hasai=remove, ai dakar=tree stumps) 2. Cermonia sau batar (sau=follow) [i.e., to follow in the ritual way of the ancestors]	1. Prior to harvest 2. Before harvesting is finished	1. Betel leaf, betel nut, maize 2. Betel nut, betel leaf and chicken	1. To seek permission from ancestor in order to start the harvest 2. To give thanks for the harvest, and declare the new maize ready to eat
Letefoho (Manfahi)	Mambae	1. New garden ritual 2. Pre-consumption ritual	1. Hu'u ai luta (hu'u: to fetch, ai luta=ai tukan/tree stumps) 2. Sau batar	1. Before opening a new garden 2. Prior to consuming maize from new harvest	1. Chicken, goat and pig if able 2. Chicken, goat and pig if able	1. So that wind and animals such as rats do not damage the crop 2. So that the new maize can be eaten
Daru Lete (Liquica)	Mambae	1. Pre-planting ritual 2. Cob formation ritual 3. Pre-harvest/pre-consumption ritual	1. Cermonia hrua sela (hrua=to plant, sela=maize) 2. Cermonia tar man hatu (tar=to cut, man=sacred, hatu=rock) 3. Cermonia sau sela (sau=follow, sela=maize) [i.e., to follow in the ritual way of the ancestors]	1. Prior to planting 2. When cobs are formed 3. Prior to harvest	1. No object of sacrifice 2. Betel nut, betel leaf, maize 3. Betel nut, betel leaf, maize and pig or goat	1. To prevent the seed planted from becoming damaged by animals 2. To give thanks to the ancestors 3. To give thanks for the harvest

⁵ The calendrical new year i.e., January 1.

Gugleur (Liquica)	Tokodede	1. Opening new garden ritual (prior to burning) 2. Post-harvest ritual	1. Cermonia sai rae tali (sai=remove, rai=the land, tali=thorn) 2. Cermonia api resa (api=fire, resa=remainder) 3. Posi ruku (posi=to give thanks, ruku=garden)	1. Prior to opening a new garden 2. After burning the garden 3. After maize harvest	1. Betel nut, betel leaf, beverage, goat or pig. 2. Betel nut, betel leaf, pig or goat 3. Betel nut, betel leaf, beverage, pig or goat	1. To ask the spirit custodian (<i>rai nain</i>) to support continued growth of the crop 2. To prevent the spread of fire from the new garden 3. To give thanks for the harvest
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Table 16. continued

Location	language	Type of ritual	Name of ritual in local language	Timing of ritual	Object of sacrifice	Objective of ritual
Vatuvao (Liquica)	Tokodede	1. Opening new garden ritual 2. Post-harvest ritual 3. Post-harvest/pre-consumption ritual	1. Ceremonia sai rai tara (sai=remove, rai=the land, tara=thorn) 2. Sul sele roa (sul=to burn, sele=maize, roa=leaf/skin/sheath) [refers to the burning of sheaths peeled from the maize cooked and eaten during the course of the ritual] 3. Posi ruku (posi=to give thanks) or Datu kai turu (datu=to place, kai=wood, tur=to sit) [refers to a piece or plank of wood located in the middle of the field and used as a place to hold the seed, and a place to hold sacrificial objects at the time of rituals]	1. Prior to opening a new garden 2. Directly after maize harvest 3. Prior to consuming the new maize	1. Betel nut, betel leaf, beverage and goat or pig. 2. Betel nut, betel leaf, maize leaf and black wood. 3. Betel nut, betel leaf, maize, rice, money, and pig or goat	1. To move the spirit custodian (<i>rai nain</i>) from the new garden to another place 2. To give thanks for the healthy-growing maize 3. To give thanks to the spirit custodian (<i>rai nain</i>) for the harvest
Maubaralisa (Liquica)	Tokodede	1. 'Thorn removal' ritual 2. Pre-planting ritual 3. Post-harvest/pre-consumption ritual	1. Sai rae tara (sai=remove, rai=the land, tara=thorn) 2. Rusa sele fini (rusu=scatter, sele=maize, fini=seed) 3. Datu kai turu/posi ruku (posi=to give thanks, ruku=garden)	1. Prior to slash and burn 2. Prior to planting 3. After harvest	1. Betel nut, betel leaf, beverage, and goat or pig. 2. Betel nut, betel leaf, coconut milk 3. Goat, pig and cooked maize	1. To prevent accident during burn and slashing activities 2. To 'warm' the seed, flicking (<i>hikis</i>) it with coconut milk so that it grows well 3. missing data
Dato (Liquica)	Tokodede	1. Pre-planting ritual 2. Post-harvest/pre-consumption ritual	1. Ceremonia suma hini (suma=prepare, hini=seed) 2. Ceremonia sulu se'e roa (sulu=to burn, se'e=maize, roa=leaf/skin/sheath) [refers to the burning of sheaths peeled from the maize cooked and eaten during the course of the ritual]	1. Prior to planting 2. After harvest	1. Betel nut, betel leaf, some animal (chicken, goat or pig)	1. To give thanks for the harvest
Garuwai (Baucau)	Makassae	1. 'Feeding sacred rocks' ritual. 2. Maize tying ritual 3. Pre-harvest ritual 4. Mid-harvest ritual	1. Buna faan (buna=rock, faan=to feed) [refers to the objects sacrificed on the sacred rock in the name of the deceased ancestors] 2. Teli gi lubu toil (teli=maize, gi lubu =its sheath/skin/tip, toil=suspend/hang) 3. Buna gi duro (buna=rock, gi duro=its part) 4. Teli safar rau (teli=maize,	1. Prior to planting 2. When maize begins flowering 3. Prior to harvest 4. Before completion of the harvest	1. Betel leaf, eggs end rice 2. Betel nut, betel leaf, goat or pig 3. Betel nut, betel leaf, and maize 4. Betel nut, betel leaf,	1. To ask for help with seed germination and growth in order to produce a good yield 2. To give thanks to the forefathers who first opened the garden 3. To 'feed the sacred rock' (give thanks prior to harvest)

			sufa=new, rau=gather)		goat, pig, and chicken	4. To prevent weevil damage to new harvest
Loilubo (Baucau)	Waimua	1. Pre-harvest ritual	Dare kera mori (dare=to follow, kera=maize, mori=new) [i.e., to follow in the ritual way of the ancestors]	1. Before completion of the harvest	1. Betel nut, betel leaf, goat, pig, chicken, and 12 maize cobs.	1. To prevent disease in the new harvest, and lengthen the duration of storage (i.e., in terms of weevil damage, and the length of time before food reserves in storage are exhausted)

Table 17. Maize: leadership and participation in religious rituals

Location	Type of ritual	Person who leads this ritual	Household/s participating in this ritual
Manucasa (Aileu)	Pre-consumption of new maize ritual	Head of the household	Single household only, can invite members of the extended family living elsewhere
Sarin (Aileu)	1. Post-harvest/pre-consumption ritual 2. Missing data	1. Ritual elder (Tetum: Lia nain) 2. Male head of the household (Tetum: xefe de familia)	1. All members of the same ritual house 2. Single household only
Seloi kraik (Alicu)	1. Pre-planting ritual 2. Pre-harvest ritual	1. Ritual elder 2. Ritual elder	1. 4-5 households whose gardens share boundaries 2. 4-5 households whose gardens share boundaries
Betano (Manufahi)	1. Pre-maize planting ritual 2. Maize flowering ritual 3. Pre-harvest ritual	1. Male head of household 2. Male head of household 3. Male head of household	1. 1-3 households (those people who planted the maize) 2. 1-3 households (those people who planted the maize) 3. All member households of the same ritual house
Dotik (Manufahi)	1. Pre-harvest ritual 2. Post-harvest/pre-consumption ritual	1. Ritual elder 2. Ritual elder	1. 7-8 households whose gardens are proximate 2. All member households of the same ritual house
Letefoho (Manufahi)	1. New garden ritual 2. Pre-consumption ritual	1. Ritual elder 2. Ritual elder	1. 5-4 households whose gardens are proximate 2. Member households of the same ritual house
Daru Lete (Liquica)	1. Pre-planting ritual 2. Cob formation ritual 3. Harvest ritual	1. Male head of the household 2. Ritual elder 3. Ritual elder	1. 5-6 households, children can also attend 2. Generally, all members of the same ritual house 3. Generally, all members of the same ritual house
Gugleur (Liquica)	1. Opening new garden ritual (prior to burning) 2. Post-harvest/pre-consumption ritual	1&2&3. Ritual specialist	1&2&3. Approximately 20 households – those whose gardens share boundaries
Vatuvao (Liquica)	1. Opening new garden ritual 2. Post-harvest/pre-consumption ritual 3. Post-harvest/pre-consumption ritual (prior to eating new maize)	1. Ritual elder 2. Ritual elder 3. Ritual elder	1. 20 households (depending on the number of farmers who assisted prepare the garden together i.e., mutual labour group members, can be as many as 50-70 households) 2. same as #1 3. same as #1
Maubaralisa (Liquica)	1. 'Thorn removal' ritual 2. Pre-planting ritual 3. Post-harvest/pre-consumption ritual	1&2. Ritual elder (mentioned as 'rai nain' by respondent) – this person is said to "hold the power for betel leaf and areca nut" i.e., knows how to speak to the ancestors	1&2. 20-30 households
Dato (Liquica)	1. Pre-planting ritual 2. Post-harvest/pre-consumption ritual	1&2. Head of the household (Tetum: xefe de familia)	1&2. Single household only (farmer only)
Garuwai (Baucau)	1. 'Feeding sacred rocks' ritual. 2. Maize tying ritual 3. Pre-harvest ritual 4. Pre-consumption ritual	1&2&3&4. Ritual elder	1. Single household only and ritual specialist 2. Single household only and ritual specialist 3. Single household only and ritual specialist 4. All households that are members of the same ritual house

Loilubo (Baucau)	Pre-harvest ritual	Ritual elder	All households that are members of the same ritual house
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1.4 Division of labour for maize cultivation

For maize cultivation, labour is organized either as a mixed mutual labour group, or a mixed or gender-restricted household group. Depending on the size of the crop and the labour demand and availability at the household level, a task is carried out at the level of the household, or household members may participate in a mutual labour exchange group.

Mutual labour exchange

In the context of cultivating maize, mutual labour exchange groups comprise members of the household, members of the extended family, and neighbours who are not kin but whose gardens may share a boundary or be proximate. Mutual labour groups were not gender-restricted, and were used predominantly for the activities of:

- planting maize (81% of respondents)
- garden clearing (up to 80%)
- harvesting maize (up to 62%)
- weeding maize (44%)

Note that the size of a mutual labour group may differ depending on the activity, for example, the activity of planting maize seed may involve as few as three people. Additionally, almost 20% of remaining respondents claimed that they used *either* mutual labour groups or household groups, depending on labour availability, for the activities of clearing and harvesting. Combining these results, it can be said that up to 80% of respondents used mutual labour groups for clearing gardens for planting maize, for planting maize, and up to 62% for harvesting maize. This result reflects the level of labour required for the activities of clearing, planting, weeding and harvesting, and demonstrates the extent of mutual labour group co-operation across at least four main activities in the cultivation cycle for maize.

The dominance of mutual labour exchange for cultivating maize has implications for adoption of SoL varieties; offering an existing network for distributing new varieties. The existence of mutual labour as an institution suggests that the size of a maize garden of any household need not be restricted to the labour capacity of that household alone, although the capacity to reciprocally offer labour to other group members is usually necessary.

Table 18. Maize: activities carried out by mutual labour groups

Commodity	Number of farmers	Garden preparation	Planting	Weeding	Harvesting
Maize	16	Up to 80%	81%	44%	Up to 62%

Mixed household

The mixed household formation is the second most dominant labour formation after mutual labour exchange. Mixed household groups carry out several activities: drying (58% or 7 out of 12 respondents), storage (53% or 8 out of 15 respondents), weeding (up to 50% or 8 out of 16 respondents including one respondent who used *either* mixed household or mutual labour group), harvesting (up to 43% or 7 out of 16 respondents including 3 respondents who used *either* mixed household or mutual labour group), garden preparation (up to 37% or 6 out of 16 respondents including 3 respondents who used *either* mixed household or mutual labour group), and planting (12% or 2 out of 16 respondents).

Table 19. Maize: activities carried out by mixed household groups

Commodity	Number of farmers	Seed preparation	Garden preparation	Planting	Weeding	Harvesting	Drying	Storing
Maize	16	20%	Up to 37%	12%	Up to 50%	Up to 43%	58%	53%

Gender-restricted household

Women-only or men-only household groups draw on women or male members of the household as well as the extended family depending on the labour requirement of the task. In the context of maize cultivation, mixed household groups are more prevalent than gender-restricted household groups (household groups comprising women primarily, or men primarily). There is a tendency for weeding to be undertaken by household groups comprising mainly male members, while the planting and storing of maize seed is undertaken by household groups comprising mainly female members. More specifically, 80% of respondents used female household groups for preparing seed, 30% used these groups for storing maize, 12% for both harvesting and drying, and 6% for planting. Male household groups carried out drying in 20% of respondents, as well as storage (12%) and weeding (6%).

Table 20. Maize: activities carried out by women-only household groups

Commodity	Number of farmers	Seed preparation	Planting	Harvesting	Drying	Storing
Maize	16	80%	6%	12%	12%	30%

1.5 Maize varieties

Table 21. Variety table for long-season maize by village

District	Sub-district	Village	Elevation	Name of variety in Tetun	Name of variety in local language	First planted	Colour characteristic	Reason farmers like this variety	Duration planting to harvest
Aileu	Aileu	Lausi	906m	Batar bo'ot	Batar tuun (Mambae)	Since the time of our ancestors	Yellow, White, and maroon	Adaptible and stores well (± 2 years)	3 months
	Aileu	Sarin	935m	1. Batar mutin 2. Batar kinur	1. Batar butin (Mambae) 2. Batar kemen (Mambae)	Since the time of our ancestors	1. White 2. Yellow	1. Soft kernel that can be processed/cooked as porridge 2. Weevil resistant	1. 4 months 2. 4 months
	Aileu	Seloi kraik	1077m	Batar bo'ot	Sel tun (Mambae)	Since the time of our ancestors	Yellow and white	Well adapted to local soil conditions	In 4 months able to harvest fresh cobs for eat and may harvest in 5 months.
	Liquidoe	Manucasa	1363m	Batar bo'ot	Batar tuun (Mambae)	Since the time of our ancestors	Yellow and white	Weevil resistant, white soft kernel easily eaten by babies and the infirm	6 months
Baucau	Baucau	Garuwai	680m	1. Batar bo'ot 2. SW5	1. Teli bere (Makassae) 2. Teli bere (Makassae)	1. Since the time of our ancestors 2. Since September 2005	1. Red, yellow 2. Red, yellow	1. Soft to eat 2. Soft to eat, delicious	1. 3 months 2. 3 months
	Baucau	Sesal	7m	Batar rai nain	Teli bere (Makassae)	Since the time of our ancestors	White, yellow	Because grown since the time of our ancestors	3 months
	Vemasse	Loilubo	770m	1. Batar musan bo'ot 2. Batar mutin 3. Batar SOL	1. Kera solo (Waimua) 2. Kera buto (Waimua) 3. Variedade SOL	1&2. Since the time of our ancestors 3. Since October 2005	1. Yellow 2. White 3. Yellow	1&2. Strong stem, large cobs and weevil resistant 3. A new variety that we want to try	1. 3 months 2. 3 months 3. 3.5 months
Liquica	Liquica	Daru Leten	1241m	Batar bo'ot	Sel tua (Mambae)	Since the time of our ancestors	Yellow and white	Able to dominate weeds and well adapted to local soil and climate	4-5 months
	Liquica	Dato	34m	1. Batar angola 2. Batar mutin 3. Batar SOL 4. Batar malai	1. Sele angola (Tokodede) 2. Sele buti (Tokodede) 3. SW5 4. Sele malai (Tokodede)	1&2. Since the time of our ancestors 3. Since October 2005 4. Since 2000	1. Yellow 2. White 3&4. Yellow	1&2. Because grown since the time of our ancestors 3. Can store for long periods even in dry season 4. Because it was distributed by the government	1. 4-5 months 2. 4-5 months 3. 3 months 4. 3 months
	Maubara	Gugleur	78m	1. Batar kalinga 2. Batar rai nain	1. Sele kalinga (Tokodede) 2. Sele reubu (Tokodede)	1&2. Since the time of our ancestor	1. Yellow kernel 2. Red and yellow	1. Dry-season tolerant 2. Because grown since the time of our ancestors	1. 5-6 months 2. 5-6 months

Table 21. continued

District	Sub-district	Village	Elevation	Name of variety in Tetun	Name of variety in local language	First planted	Colour characteristic	Reason farmers like this variety	Duration planting to harvest
	Maubara	Maubaralisa	998m	1.Batar rai nain (batar tangerina tasak) 2.Batar gari 3.Batar angola	1.Sele daru mara (Tokodede) 2.Sele gari (Tokodede) 3.Sele angola (tokodede)	1&2&3. Since the time of our ancestors	1.Yellow kernel 2.Maroon, white, yellow 3.White kernel and Large cobs	1. Because when the kernel is pounded between two rocks, it does not produce much fine material (wastage) 2. Weevil resistant and stores well 3. Large cobs, boils well	1. 4 months 2. 4 months 3. 4 months
	Maubara	Vatuvou	9m	1.Batar bo'ot 2.Batar bo'ot	1. Sele ae buti (Tokodede) 2. Sele ae nar	1&2. Since the time of our ancestors	1.White and red 2.White and red	1&2. Easily controlled for weed (slashing), and stores well over long periods	1. 3 months 2. 3 monthss
Manufahi	Alas	Dotik	20m	1.Batar mutin 2.Batar modok	1.Batar mutin (Tetun Terik) 2.Batar modok (Tetun Terik)	1. Since the time of our ancestors 2. Since Portuguse times	1.White 2.Yellow	1. Stores well over long periods and weevil resistant 2. Good taste (sweet)	1. 3 months 2. 3 months
	Alas	Mahakidan	20m	1.Batar mutin 2.Batar modok	1.Batar mutin (Tetun Terik) 2.Batar modok (Tetun Terik)	1&2. Since the time of our ancestors	1.White 2.Yellow	1. Soft when chewed 2. Large Cobs, big kernels	1. 3 months 2. 3 months
	Same	Betano	2m	1.Batar kinur 2.Batar mutin	1.Batar geme (Mambae) 2.Batar buti (Mambae)	1. Since Indonesian times (1975-1999), commonly known as "hybrida" 2. Since the time of our ancestors	1.Yellow 2.White	1. Quick harvesting, good taste 2. Good for boiling/cooking	1. 3 months 2. 3 months
	Same	Letefoho	408m	1.Batar bo'ot 2.Batar mutin 3.Batar mustura	1.Batar bosuk (Laklei) 2.Batar buti (Mambae) 3.Batar lekmeta (Mambae)	1&2&3. Since the time of our ancestors	1.Yellow, white 2.White 3.Black, white, yellow	1.Large cobs 2.Large cobs 3.Colour variation	1. 3 months 2. 3 months 3. 3 months

Farmers categorize maize according to colour (yellow, white, red, varicolored) or size (large, small). Size also refers to length of growing season. Long season maize is known as *batar bo'ot*, literally, large maize, whereas short season maize is known as *batar lais* (quick maize) also known as *batar ki'ik* (small maize). Farmers generally plant at least two varieties of both long season and short season maize, i.e., four types in total. Respondents were asked to explain the positive characteristics of each variety of maize planted. Characteristics mentioned can be categorized as follows: weevil tolerance, taste, cob size, weeding and processing.

- Taste. Six farmers (37%) mentioned taste as an attribute of five maize varieties, with four of these farmers mentioning soft to eat (*mamar*) and suitability for processing as maize gruel or porridge known as *sasoru*. Different respondents viewed different varieties to be soft to eat e.g., white maize (Mahakidan, Manucasa), red maize (Garuwai), and yellow maize (Garuwai, Manucasa). Two respondents mentioned tasty to eat after boiling (white maize, Betano) and one mentioned sweetness (yellow maize).⁶ Note that it is short season maize that tends to be cooked to become 'pop corn', a popular preparation of maize.
- Weevil resistance. Of the sixteen farmers interviewed, five (31%) mentioned resistance to weevils in three varieties: white maize (Dotik, Manucasa), yellow maize (Manucasa, Sarin), varicolored maize – red, white, dark yellow (Maubaralisa, Lausi).
- Cob size. Four farmers (25%) mentioned the large size of the maize cob as a characteristic of the following varieties: yellow (Mahakidan, Loilubo), white maize (Letefoho, Loilubo), 'angola' (Maubaralisa) and yellow and white (Loilubo).
- Easy to weed. Two farmers mentioned easy weeding as the characteristic of several varieties. White and yellow maize varieties were claimed to dominate weeds (Daru Leten), while white and red varieties were said to allow easy slashing of weeds (Vatunao) without the need to dig the roots with a digging stick and pull out by hand.
- Processing. One farmer (Maubaralisa) mentioned the local yellow maize 'batar tangerine tasak' as a variety producing less grit (and therefore, more wastage) when pounded with stones, a process known as '*tuku batar*'.

Over half of the study respondents defined short season maize as a valuable food source during the food shortage period (Tetum: *ai han menus*) when the reserve supply has been exhausted, and the long season maize has yet to be harvested.

'tuir avo sira nia tempo batar lais ne'e labarik sira nian' = according to the time of our ancestors [they said] quick maize belongs to the children (respondent, Gugleur)

Short-season maize or 'quick' maize does not require performance of a religious ritual prior to consumption. Reasons given by respondents for explaining this difference focus on the nature and use of this maize as a small, short-cobbed variety grown in a small quantity to 'tide over' the household for a 3-4 week period until the harvest of the principal crop of maize (i.e., long-season maize). As a bridging food, short-season maize is said to be grown for children to satisfy their hungry while waiting for the main maize crop. Unlike long-season maize, short-season maize is not cultivated with the aim of storing as a reserve food during the dry season. It can be surmised that because there is no dire dependency on short-season maize as a staple food, that is, farmers do not depend on a successful harvest of short-season maize in order to keep as a food reserve throughout the rest of the year, there is no institutionalized or formalized expression of gratitude to the ancestors for this harvest.

⁶ SoL agronomist Luis Almeida makes the point that there is some linguistic ambiguity in color identification. '*Modok*' means green in Tetun Dili, but in some other languages such as Tetun Tetik '*modok*' means yellow.

Table 22. Variety table for short season maize, by village

District	Sub-district	Village	Name of variety in local language	Name of variety in Tetun	Length of time planted	Colour characteristic	Reason for growing this variety	Duration planting until harvest
Aileu	Aileu	Lausi	Batar loban (Mambae)	Batar lais	Since the time of our ancestors	Yellow and maroon	Early harvesting	1. 5 months
	Aileu	Seloi Kraik	1.Sel mroea kmen (Mambae) 2.Sel mroea auslekun	1.Batar lais kinur lotuk 2.Batar lais mutin	1. Since Indonesian times (1975-99) 2. Since the time of our ancestors	1. Yellow 2. White	1&2. Source of food for children during hungry period, early harvest	1. 3 months 2. 3 months
	Liquidoe	Manucasa	1.Batar maus meran (Mambae) 2.Batar maus kmen (Mambae)	1.Batar lais mean 2.Batar lais kinur	1&2. Since the time of our ancestors	1. Red 2. Yellow	1&2 Source of food for children during hungry period, early harvest	1. 3 months 2. 3 months
Baucau	Baucau	Garuwai	Teli mata (Makassae)	Batar lais	Since the time of our ancestors	Yellow and red	Soft to eat, early harvest	3 months
	Vemasse	Loilubo	Keral hai	Batar lais	Since the time of our ancestors	Yellow	Early harvest	2 months
	Vemasse	Vemasse tasi	Kera Lhai (Waimua)	Batar lais	Since the time of our ancestors	Yellow, white, vari-coloured	Soft to eat, early harvest	2.5 months
Liquica	Liquica	Daru Leten	Sel mroea as lekun (Mambae)	Batar lais ki'ik	Since the time of our ancestors	Small kernel, vari-coloured, yellow and white	Early harvest, source of food during hungry season December and January	2-3 months
	Maubara	Gugleur	1.Sel brue meo 2.Sel brue buti	1.Batar lais mean 2.Batar lais mutin	1&2. Since the time of our ancestors	1. Red 2. White	1. Early harvest 2. Dried corn tastes like fresh corn when fried (popcorn)	1. 2-3 months 2. 2-3 months
	Maubara	Maubaralisa	1.Sele broe buti (Tokodede) 2.Sele broe as leku (Tokodede)	1.Batar mutin 2.Batar mean	1&2. Since the time of our ancestors	1. White 2. Red	1&2. Early harvest, food source in hungry season.	1. 2-3 months 2. 2-3 months
	Maubara	Vatunao	.Sele bureo buti (Tokodede)	Batar local	Since the time of our ancestors	White	Sweet, good taste	2.5 months
Manufahi	Alas	Mahakidan	Batar lais ahnoku (Tetun Terik)	Batar lais mutin mos	Since the time of our ancestors	Pure white	Early harvest, source of food in hungry season	2 months
	Same	Betano	Batar mroea (Mambae)	Batar lais fu'uk rua	Since the time of our ancestors	White and yellow	Source of food in hungry season	2.5 months
	Same	Letefoho	1.Batar ken (Laklei) 2.Batar butin (Laklei) 3.Batar kusi metan (Laklei)	1.Batar lais kinur 2.Batar lais mutin 3.Batar lais mustura	1&2&3. Since the time of our ancestors	1. Yellow 2. White 3. Vari-coloured	1&2&3. Source of food in hungry season particularly for children	1. 2 months 2. 2 months 3. 2 months (Planted November, harvested January)

Clearly, short season maize is a critical component of most Timorese farmers' food security strategy. Preferred characteristics of the types of short season maize planted were categorized in terms of taste and cob size.

- Taste. Three farmers mentioned taste as an important attribute for short-season maize. Soft texture (Tetum: *mamar*) was mentioned for: yellow and red maize (Garuwai), and yellow, and white speckled (Vemasse). Sweetness was mentioned for white maize (Vatunao), and white maize was also said to fry well as popcorn (Gugleur).
- Cob size. One farmer mentioned the large size of the short season maize cob as a preferred characteristic of the white and red variety (Vatunao).
- Adapted to climate/soil. One farmer (Vatunao, elevation 9m) mentioned ‘hibrida’ short season maize (white and red) to be well-adapted to the hot weather of the low lying coastal land.

Each farmer interviewed planted at least two varieties of short season maize. All farmers claimed that the varieties used currently had been planted since the time of their ancestors. Like long season maize, farmers categorise short season maize varieties according to color. Additionally, in Liquisa farmers classified short season maize based on short-cobbed maize that ties well (white maize), and long-cobbed maize that does not tie well (vari-colored).

Table 23. First and second season harvest times for short season maize, by village

District	Sub-district	Village	First season planting and harvest	Second season planting and harvest
Aileu	Aileu	Seloi Kraik	Plant: October-November Harvest: January	No second season
	Liquidoe	Manucasa	Plant: October Harvest : January-February	No second season
Baucau	Baucau	Garuwai	Plant: November Harvest: February	No second season
	Vemasse	Loilubo	Plant: November Harvest: February	No second season
	Vemasse	Vemasse tasi	Plant: November Harvest: February	No second season
Liquica	Liquica	Daru Leten	Plant: October Harvest: February	No second season
	Maubara	Gugleur	Plant: November Harvest : January-February	Plant : March-April Harvest young maize : June Harvest dried maize: July
	Maubara	Maubaralisa	Plant: October-November Harvest: January-February	No second season
	Maubara	Vatuvou	Plant: November Harvest: February-March	No second season
Manufahi	Alas	Mahakidan	Plant: November-December Harvest: January-February	Plant : May Harvest: end of July
	Same	Betano	Plant: December-January Harvest: March	Plant: May-June Harvest young maize: July Harvest dried maize: end of July-August
	Same	Letefoho	Plant: November Harvest: January	Plant: April-May Harvest young maize: July Harvest dried maize: end of July

Short-season maize was grown by 12 study respondents, compared with 16 growing long season maize. Those respondents who did not grow short-season maize were spread across all districts: Sesal (Baucau), Dato (Liquica), Dotik (Manufahi), and Sarin (Aileu). The only pattern is the low-lying, coastal nature of Sesal (7m), Dato (34m), and Dotik (20m) which may cause farmers to prioritise the planting of long-season maize only, however this needs further exploration. Those farmers growing short-season maize

twice were confined to Manufahi district (Mahakidan, Betano, Letefoho) where farmers are able to take advantage of the second rainy period, and Gugleur in Liquica.

The respondent from Vemasse Tasi grows one season of short-season maize, and no long-season maize at all. The labour requirements of cultivating a large crop of long-season maize coincided with the cultivation of two seasons of upland rice annually and one season of irrigated rice. Activities associated with first season cultivation of upland rice coincide with the cultivation cycle for long-season maize, and planting of irrigated rice coincides with weeding maize.

Rice

Irrigated and upland varieties of rice have long been cultivated in Timor Leste, and provided an important component of Timorese diets. Rice is generally regarded as a food of high status and the food of choice for ceremonial and special occasions. The promotion of irrigated rice agriculture by the Portuguese in the 1960s and especially the Indonesians after 1975, significantly increase production levels and areas under cultivation. High yielding varieties in particular from IRRI (Philippines) contributed to rapid adoption of rice farming by Timorese in areas such as Uato Lari (Viqueque) and later Maliana (Bobonaro) and Covalima under the Indonesians who shifted the production areas of rice to the west. After 1975, significant investment in irrigation infrastructure and production subsidies on fertilizer and pesticides contributed to increased rice production throughout the territory and greater consumption of rice by Timorese populations. Most of the irrigated rice lands are lowland production sites, although there are a number of upland terraced rice areas which may be of some antiquity.

Yield per hectare of rice is about 1.5 metric tonnes/ ha, which is still low compared to other rice-growing countries in the region. Rice production was estimated to be about 58,000 tons in 2001, substantially below the average of about 68,000 tons a year in the five-year period 1994-1998. Despite the adverse effects of El Nino on the production of maize and other food crops in FY2002/03, rice production rose by some 12 percent and is expected to rise further with the use of improved seeds and fertilizers and continued rehabilitation of irrigation schemes (MAFF 2004).

It is observed however, that domestic rice production does not meet demand in Timor Leste and the nation currently imports around 4000 tonnes of rice per month to meet production shortfalls (48000t/pa) mainly from Thailand, Vietnam and India. In response to the negative impact of cheap rice imports, the government has placed a 12% tax on rice importing to encourage local production although according to government documents, the situation is unlikely to change unless transport facilities banking and micro-finance facilities are more fully developed (MAFF 2004). It is worth noting that the recommendations of the Hawaiian study in the Seical River region indicated that rice yields could be significantly increased (by around 50%) through better farming techniques and management (Alexander 2004).

Production is also limited by single annual cropping of rice in most areas. It is estimated that less than 20% of the irrigated rice areas produce a second crop within the year. This situation is largely due to the lack of an assured supply as river levels decline during the dry season, but other factors may be significant such as competition for grazing by livestock and other agricultural commitments.

Since the turmoil of 1999 when significant numbers of livestock and mechanical equipment was destroyed, the current situation shows a marked improvement with widespread use of hand tractors for land preparation in rice irrigation areas

2. Upland rice (Tetum: natar rai maran)

Upland rice refers to rice usually grown in a non-bunded ricefield located on sloping terrain. Lowland rain-fed rice refers to rice grown in lowland areas in bunded ricefields. In the Tetum language, both of these rice cultivation practices are known as natar rai maran, literally, dryland ricefield. The other rice cultivation practice is simply known as irrigated rice. Among respondents interviewed, all cultivated upland rice (Loilubo, Vemasse Tasi, Gugleur, Letefoho, Dotik). For the purposes of this section, the term 'upland rice' is used as a gloss to refer as 'natar rai maran' in the Tetum language does, to non-irrigated rice.

2.1 Planting times

Table 24. Upland rice: planting times for first season

District	Village	Elevation	Time of planting	Time of harvest
Baucau	Loilubo	770m	December	March and April
Baucau	Vemasse tasi	255m	After rain has fallen for two weeks (usually third and fourth week of November)	End of May
Liquica	Gugleur	78m	August and September	February and March
Manufahi	Letefoho	408m	October	March
Manufahi	Dotik	20m	November	March

Table 25. Upland rice: planting times for second season

District	Village	Elevation	Time of planting	Time of harvest
Baucau	Vemasse tasi	255m	April	July

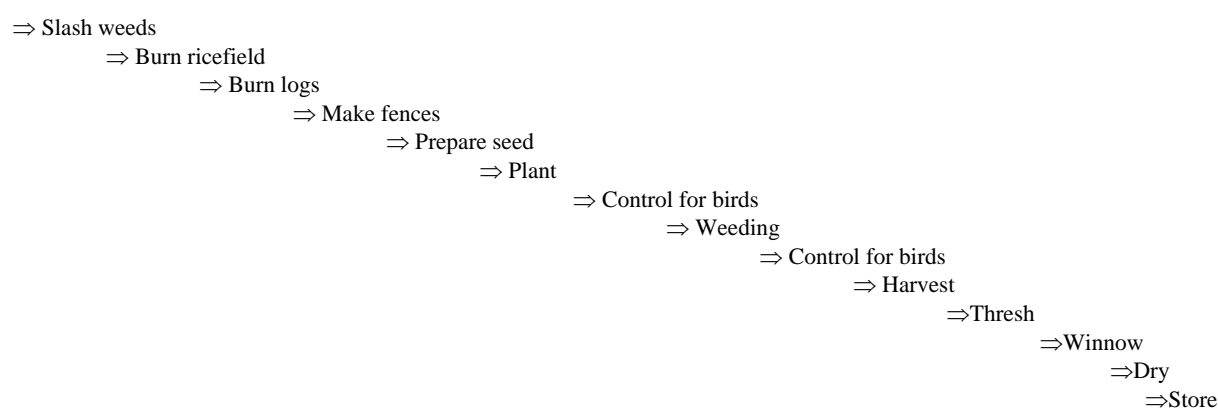
Table 26. Upland rice: signs for planting

District	Village	Elevation	Sign for planting upland rice
Manufahi	Lete foho	408m	Plant 1 week before rain
Manufahi	Dotik	20m	Plant after rain has fallen for 1 full day and soaked the ground
Liquica	Gugleur	78m	Plant 1-2 weeks before rain
Baucau	Vemasse tasi	255m	Plant 1 week before rain
Baucau	Loilubo	770m	Plant 1-2 weeks after rain has fallen and after maize has been planted

Among the five respondents who planted upland rice, two-thirds planted rice after rain with waiting time differing from place to place. The remaining three farmers planted upland rice before rain.

2.2 Cultivating upland rice

Diagram 2. General pattern of the sequence of upland rice cultivation activity



Five out of the seventeen farmers interviewed in this study cultivated non-irrigated rice. The cycle depicted above, particularly the ricefield preparation (slashing weeds, burning the ground) broadly represents the pattern of cultivation for four farmers in Manufahi (Letefoho), Liquica (Maubara), and Baucau (Welakama and Loilubo).

Preparation of upland ricefields resembles the preparation undertaken for commodities such as maize, cassava and sweet potato, that is, weeds are slashed, the garden is burned, and trees are reduced to ash. More intense burning activity is carried out for upland ricefields. For example, a second or third activity of burning might be undertaken to re-burn stumps and roots of felled trees or shrubs. In some places such as Welakama in Baucau district, farmers use a burning method known as *loin* where dried bamboo and its roots are lit, and then the burning bamboo is systematically dragged across remaining weeds or stumps in the ricefield to further reduce their mass.

Upland ricefields (except Vemase Tasi) tend to be cropped for about 2 years and fallowed for a period of 2-3 years:

- Letefoho: ricefield is abandoned after 1 year of cropping, and fallowed for 1-2 years
- Gugleur: ricefield is abandoned after three years of cropping, and fallowed for 2-3 years
- Loilubo: ricefield is abandoned after 1-2 years, and fallow period depends on when the soil has become fertile again

Rice seed preparation

All upland rice farmers interviewed prepared rice seed using the same method: they winnow and separate the husk from the rice grain. Respondents used digging sticks or their hands to plant several dry rice grains directly into the ricefield (3-4 grains in Loilubo, 4-5 grains in Maubara, and 7-8 grains in Letefoho and Woelakama).

Planting

The method of closing over the planting hole depends on the position of the planter. From a squatting position, the hands are used to close over the hole, and from a standing position the foot is used to cover over the hole. The tapered end of the digging stick may also be used. In two places only - Loilubo and Woelakama in Baucau district - farmers plant rice in rows using a string for alignment. In all other places planting is done arbitrarily.

Some farmers planted other food varieties in the same area as upland rice, and some planted upland rice separately. For example, the respondent in Letefoho planted maize, cassava, arrowroot and sweet potato in the same area as upland rice, in Woelakama the respondent planted upland rice with peanuts and maize, while in Gugleur the respondent planted maize only with upland rice. In Loilubo, the respondent preferred to plant upland rice separately, claiming that co-planting with other food varieties attracts rats which destroy the rice crop.

Weeding

Farmers used digging sticks or small machete to dig out weeds, then pulled them out by hand. Hoes and large machetes were used for slashing weeds on bunds. All upland rice farmers interviewed used rice stalks after harvesting. Rice stalks remaining in the ricefield after harvest as well as rice stalks left behind after threshing, are used for making humus. Where a rice farmer also grows maize nearby, rice stalks may be gathered as humus for maize (Letefoho, Gugleur, Woelakama, Loilubo). These rice stalks are then left to decompose and become humus in the maize garden itself. Farmers may also lay rice stalks on seedling beds (Tetum: *kantadeiro*) to decompose and become humus. Some farmers burned rice stalks in order to dry the soil (Woelakama). Other sources suggest that the purpose of drying the soil is to prevent ants. Rice farmers may also feed rice stalks to horses and cattle.

2.3 Religious rituals undertaken during the cultivation of upland rice

Like the other staple food maize, religious rituals are integral to the upland rice cultivation cycle. Objects of sacrifice are identical to those for rituals associated with maize and irrigated rice: betel leaf and areca

nut, and domesticated animals (chicken, goat, pig). The particular sacrifice is prescribed depending on the ritual. The sacrifice functions to invoke or call up the protection of the ancestors and God against the risk of accident or misfortune such as: fire spreading to neighbours' gardens at the time of burning the ricefield, and pests or animals damaging the rice while it is growing. Some farmers perceived themselves as constrained from harvesting and consuming the new rice before the appropriate rituals and procedures had been performed. Performing the ritual lifts the prohibition, removing the risk of misfortune such as crop failure or injury (e.g., felling trees during garden cultivation), or illness from eating the new rice.

Religious rituals in the cultivation cycle of upland rice were carried out by four out of five respondents (Loilubo being the exception). A list of times when rituals were conducted follows:

- before burning the rice field
- before planting
- when the rice is growing vigorously
- before harvesting
- before gathering up the rice sheaths
- before storing the rice
- after storing the rice

A few preliminary observations can be made about the relation between the type of ritual and leadership and attendance. First, unlike maize, none of the rituals associated with upland rice are performed in the ritual house and attended by those households that constitute the membership of that ritual house. Rather, among those study respondents interviewed, participation in upland rice rituals is based on participation in cultivation. In other words, it is the members of the mutual labour exchange group or extended family who assisted plant or weed or harvest, who are invited to attend.

Table 27. Upland rice: religious rituals associated with cultivation, by village

Suco	Local language	Name of ritual (local language)	Timing of ritual	Object of sacrifice	Objective of ritual
Letefoho	Laklei	1. Krua lamu (krua=to plant, lamu=garden) 2. Hatuk tian (hatuk=stone, tian=sacred place inside of the ricefield)	1. Before planting rice 2. Before harvesting rice	1. Goat, pig or fowl 2. Fowl, pig	1. So that wild animals do not destroy the crop 2. To give thanks to God and the ancestors for the harvest
Dotik	Tetun Terik	Hisik rai (hisik=to sprinkle, rai=ground)	Before planting	Pig, betel leaf, coconut	So that the crop will be successful
Gugleur	Tokodede	1. Rusa lapar wini (rusa=to sprinkle, lapar=objects/goods, wini=seeds) 2. Klobu resa (klobu=to cut, resa=rice)	1. Before burning the ricefield 2. After harvest	1. Chicken, and if possible, goat or pig 2. Pig and/or goat	1. So that animals do not damage the crop, and the crop yields well 2. So that the rice does not diminish or become less through the process of threshing, and to give thanks to the ancestors
Woelakama	Waimua	1. Nukuse'e ra (nukuse'e ra=cut the rice leaves) 2. Daku se'e (Daku=remove the risk husk and thresh, se'e=rice) 3. Loi dene ehe dene la'a maha rere (Loi=to tell, dene=to hear, ehe=to speak,	1. When rice is growing vigorously 2. Before gathering up the sheaths of rice 3. Before	1. Goat, pig or fowl 2. Areca nut, betel leaf, and water 3. Pig, goat, or	1. So that the rice will grow vigorously 2. To ask the ancestors that the rice harvest is plentiful and does not "leak out from the <i>hokan</i> (basket) in which it is stored" [that is, there is no

		la'a=to, maharere=ancestors) 4. Thunu lawaga (thunu=to bake/grill, lawaga=debu/dust)	storing rice 4. After storing rice	fowl 4. Pig, goat, fowl and water	wastage and supplies do not become depleted quickly] 3. So that rice from the new harvest can be consumed without illness 4. To give thanks for the harvest
Seloi kraik	Mambae	1. Fun tuir aroen (fun tuir= to copy/follow, aroen=ricefield) [i.e., to follow in the ritual way of the ancestors]	1. Prior to planting	1. Pig or chicken	1. So that rats will not eat or destroy the rice

Table 28. Upland rice: participation in religious rituals by village

Village	Name of ritual (local language)	Timing of ritual	Person leading the ritual	Household/s participating in the ritual
Letefoho (Manufahi)	1. Krua lamu (krua=to plant, lamu=garden) 2. Hatuk tian (hatuk=stone, tian=sacred place inside of the ricefield)	1. Before planting rice 2. Before harvesting rice	1. Male head of household 2. Male head of household	1. 5-6 households depending on how many assisted plant (i.e., those who assisted plant) 2. same as above
Dotik (Manufahi)	Hisik rai (hisik=sprinkle, rai=ground)	Before planting	Ritual elder	7-8 households that participated in preparing the ricefield
Gugleur (Liquisa)	1. Rusa lapar wini (rusa=to sprinkle, lapar=objects/goods, wini=seeds) 2. Klobu resa (klobu=to cut, resa=rice)	1. Before burning the ricefield 2. At the time of harvest	1 & 2. Ritual elder	1. 5-6 households whose gardens share boundaries or are proximate 2. 5-6 households whose gardens share boundaries or are proximate
Woelakama (Baucau)	1. Nukuse'e ra (nukuse'e ra=cut the rice leaves) 2. Daku se'e (Daku=remove the husks and thresh, se'e=rice) 3. Loi dene ehe dene la'a maharere (Loi=to tell, dene=to hear, ehe=to speak, la'a=to, maharere=ancestors) 4. Thunu lawaga (thunu=to bake, lawaga=debu/dust)	1. When rice is growing vigorously 2. Before gathering up the sheaths of rice 3. Before storing rice 4. After storing rice	1&2&3&4. Ritual specialist (Tetum: Lia nain)	1. Approx. 5-6 households 2&3&4. Extended family
Seloi kraik (Aileu)	1. Fun tuir aroen (fun tuir= to copy/follow, aroen=ricefield) [i.e., to follow in the ritual way of the ancestors]	1. Prior to planting	Missing data	Missing data

Table 29. Upland rice: varieties used for rituals by village

Suco	Variety used	Process of cooking
Seloi Kraik	Any variety	Boiled the same as everyday rice
Letefoho	Black, red and white	Boiled the same as everyday rice
Dotik	Any variety	Boiled the same as everyday rice
Gugleur	Black, yellow	Boiled the same as everyday rice
Woelakama	Red and white, and red only	Cook inside bamboo tube (Tetum: <i>tokir</i>)
Loi-lubu	Red	Cook in clay pot (Tetum: <i>sana rai</i>) but use bamboo tube (Tetum: <i>au dora</i>) if ritual is held in the ricefield

Upland rice varieties used for ceremonial occasions include black, white, red and vari-colored red and white varieties. For ceremonial purposes, upland rice is usually boiled, although in Baucau (Woelakama, Loilubu) rice is cooked inside a tube of bamboo, or in a clay pot.

2.4 Division of labour for upland rice cultivation

Those farmers interviewed who planted upland rice organised labour in terms of three formations: as household groups, mutual labour groups, and working individually (landowner-farmer). Several preliminary observations are made below.

Mutual labour exchange

Among respondents who cultivated upland rice, their mutual labour groups were the same that they use for maize, and comprised members of the extended family (both the male head of the household's extended family and the family of his wife), as well as neighbours who have ricefields. It is proximity that is the basis of membership of the mutual labour exchange group, and members have different sized ricefields. Mutual labour groups tend to be mixed-sexed, and usually undertake ricefield preparation such as burning, ploughing, drying, and puddling the ricefield with buffalo. Based on the limited data set of five farmers only, 60% of respondents used mutual labour groups for the activities of preparing the ricefield and planting, with 40% for weeding and harvesting. Weeding and harvesting upland rice may be undertaken by either household groups or mutual labour group, depending on the household labour available, and the size of the ricefield.

The system known as 'sosi' is practiced by four out of five upland rice farmers (except Gugleur) with the arrangement differing according to location, but underpinned by the same principle of two or more partners contributing either human or material resources, and then splitting the harvest. The nature of each partner's contribution depends on the resources each partner has available, and the specific arrangement made between the parties. The following examples were given by respondents:

- One partner provides the ricefield, the other provides the labour (Selo kraik)
- One partner provides the ricefield, the other provides the rice seed or other material input, both provide labour (Loilubo, Letefoho)
- One partner provides the rice seed, one partner provides the animal for slaughtering/sacrifice at the time of the religious ritual associated with upland rice, and one partner provides the ricefield (Woelakama)
- One partner provides both rice seed and rice field, the other partner provides labour (Dotik)

Table 30. Upland rice: activities carried out by mutual labour groups

Commodity	Number of farmers	Garden preparation	Planting	Weeding	Harvesting
Upland rice	5	60%	60%	40%	40%

Mixed household groups

Mixed household groups comprising men and women carried out several activities: seed preparation and planting (each 40% or 2 out of 4 respondents); weeding (40% or 2 out of 5 respondents); harvesting (up to 40% 2 respondents including one who used *either* mixed household or mutual labour group); storage (40% or 2 out of 5 respondents); burning (25% or 1 out of 4 respondents); and preparation and threshing (each up to 20% or 1 out of 5 respondents).

Table 31. Upland rice: activities carried out by mixed household groups

Commodity	Number of farmers	Garden/ricefield preparation	Seed/runner preparation	Planting	Weeding	Harvesting	Threshing	Storing
Upland rice	5	Up to 20%	40%	40%	40%	Up to 40%	Up to 20%	40%

Gender-restricted household groups

While mutual labour groups tend to be mixed, household groups involved in the cultivation of upland rice are both mixed and gender-restricted. Household groups composed of men only, undertake more activities

related to upland rice than groups comprising women only. For example, male-only household groups carried out the activities of fencing (in 2 locations) and storing (in 2 locations), as well as ricefield preparation, burning and weeding in single locations. Whether groups are gender-restricted or not depends on labour availability at the household level in relation to the size of the ricefield.

The respondent from Woelakama (Baucau district) undertook all upland rice activities within the household due to the large number of adult-age males resident in that particular household. This male-only household group undertakes seventeen out of twenty-one activities: preparing the ricefield; drying the ricefield; burning the rice field; re-burning felled timber; re-burning the ricefield; undertaking three phases of controlling for animals; building fences and ricefield shelters; weeding the ricefield and its boundaries; preparing the tarpaulin; controlling for sparrows and other birds; transporting the harvested rice, and tying the harvested rice into sheaths. Women in the Woelakama household above undertook four activities only in relation to the household's rice harvest: preparing the rice seed; re-planting failed seed; harvesting the rice, and storing the rice.

Overall, women-only household groups were involved in seed preparation (40% or 2 out of 5 respondents), harvesting (40% or 2 out of 5 respondents) and storing (20% or 1 out of 5 respondents). While there is a tendency for men-only groups to have greater involvement in activities associated with cultivating upland rice based on the limited data available, it should be clarified that mixed household and mutual labour groups comprise both men and women. The point being that except for those gender-restricted activities in certain locations, women and men are involved in most activities associated with cultivating upland rice.

Table 32. Upland rice: activities carried out by women-only household groups

Commodity	Number of farmers	Preparing seed/runners	Harvesting	Storing
Upland rice	5	40%	40%	20%

2.5 Upland rice varieties

Table 33. Variety table for upland rice, by village

District	Sub-district	Village	Elevation	Name of variety in Tetun Language	Name of variety in Local Language	First planted	Colour of rice seed (hulled)	Reasons for growing this variety	Duration planting until harvest	Taste after cooking
Aileu	Aileu	Seloi kraik	1077m	1.Hare rita 2.Hare ai bubur musan	1. Mea rita (Mambae) 2. Mea ai foehua (Mambae)	1. Since the time of our ancestors 2. Since the time of our ancestors	1.White 2.White	1. Weighs heavier than other varieties 2. Short duration from planting to harvest	1. 5 months 2. 4 months	1. Fragrant 2. Not so fragrant
Baucau	Vemasse	Loilubo	770m	1.Hare badak 2.Hare silaun 3.Hare mean	1.Se'e beteana (Waimua) 2. Se'e silaun 3. Se'e bua geu (Waimua)	1. GTZ 2. Since the time of our ancestors 3. Since the time of our ancestorss	1.White 2.White 3.Red	1. Short duration from planting to harvest, and is harvested (cut) quickly 2. Since the time of our ancestors 3. Only 3.5 months from planting to harvest	1. 4 months 2. 5 months 3. 3-5 months depending on water	1. Fragrant 2. Fragrant 3. Eat only a little and become contented
	Vemasse	Vemasse tasi	255m	1.Hare lais 2.Hare IRA 8 3.Hare Amerika	1.Sel hane (Waimua) 2. Sel R8 (Waimua) 3.Sel hai (Waimua)	1. Since the time of our ancestors 2. During Portuguese times 3. During Indonesian times	1. Red and slightly yellow. 2. White 3. Red and yellowish	1. Harvests (cuts) quickly and requires less labour/effort 2. Harvests (cuts) quickly and requires less labour/effort 3. Short duration from planting to harvest	1. 4 months 2. 4 months 3. 2.5 months	1. Cooked dry is good to eat 2. Cooked dry is good to eat 3.Sticky when cooked, good to eat
Liquisa	Maubara	Gugleur	78m	1.Hare metan 2. Hare kinur	1.Resa meta (Tokodede) 2. Resa mege (Tokodede)	1. Since the time of our ancestors 2. Since the time of our ancestors	1.Black 2.Slightly yellow	1. Fragrant when cooked as porridge (<i>sasoro</i>), delicious even cooked on its own without beans 2. Fragrant when cooked as porridge (<i>sasoro</i>), delicious even cooked on its own without beans	1. 6 months 2. 6 months	1. Fragrant 2. Fragrant and oily
Manufahi	Same	Letefoho	408m	1.Hare metan 2.Hare hudi tasak 3. Hare ai dauk	1. Are haite (Laklei) 2. Are mubina (Laklei) 3. Are ai dauk (Laklei)	1. Since the time of our ancestors 2. Since the time of our ancestors 3. Since the time of our ancestors	1.Red 2.Red and white mixed 3.Pure white	1. Fragrant 2. Fragrant 3. Fragrant	1. 3.5 months 2. 3.5 months 3. 3.5 months	1. Fragrant 2. Fragrant 3. Fragrant
Manufahi	Alas	Dotik	20m	1.Hare kinur 2.Hare mean 3.Hare Metan 4.Hare Mutin	1.Hare kinur 2.Hare mean 3.Hare Metan 4.Hare Mutin	Missing data	1.White 2. Red 3. Black 4. White	Missing data	Missing data	Missing data

Of the five upland rice farmers surveyed, each planted two to three varieties of upland rice. Where rice was planted twice in one year, the same varieties were planted in each season. In terms of distribution of varieties, all farmers grew a white grain and a red grain variety, except in Selo Kraik (Aileu) where the respondent cultivated white husk/white grain varieties only. Most farmers had been growing the varieties they currently grew since the time of their forefathers, except for three varieties grown in Baucau district: 'IR-8' released in Vemasse tasi during the Portuguese period (pre-1975), 'Hare Amerika' released in Vemasse Tasi during the Indonesian period (1975-99), and 'Hare badak' released in Loilubo by GTZ (since 2000).

Farmers were asked to identify the positive characteristic of each variety, and these can be categorised in terms of ripening, quick harvesting, and taste.

- Four varieties of upland rice were mentioned as ripening quickly: 'ai bubar musan' (Aileu) and 'hare badak' (Loilubo) ripen in 4 months, with 'hare Amerika' (Vemasse Tasi) ripening in 2.5 months. The longest duration between planting and harvest was 6 months for both varieties grown in Gugleur, Liquica district.
- Harvest. Three varieties of upland rice were mentioned as cutting easily at harvest, and requiring less labour: 'hare lalais', 'IR-8' (Vemasse Tasi) and 'hare badak' (Loilubo).
- Taste. The fragrant character of rice was mentioned for five varieties. Three varieties mentioned as fragrant were 'hare metan', 'hare hudi tasak', and 'hare ai dauk' (Letefoho). Two varieties mentioned as being fragrant specifically when cooked as porridge (*sasoru*) were 'hare metan' and 'hare kinur' (Gugleur). Stickiness when cooked (Tetum: *belit*) was also mentioned for the variety 'Hare Amerika'.

3. Irrigated Rice (Tetum: natar irrigasaun)

3.1 Planting times

Table 34. Irrigated rice: planting times for first season by village

District	Sub-district	Suco	Elevation	Time of planting	Time of harvest
Aileu	Aileu	Sarin	935m	January (December if the rains come early)	April to May
	Aileu	Seloi kraik	1077m	End of February to March	June
Baucau	Baucau	Buroma	5m	February to March	June to September
	Vemasse	Loilubo	770m	January	June to July
	Vemasse	Vemasse tasi	255m	Between December and February	May to August
Liquica	Maubara	Gugleur	78m	November	April to May
Manufahi	Same	Betano	2m	January	April
	Same	Letefoho	408m	March	June

Table 35. Irrigated rice: planting times for second season by village

District	Sub-district	Suco	Elevation	Time of planting	Time of harvest
Liquica	Maubara	Gugleur	78m	May	August and September
Manufahi	Same	Betano	2m	April and May	August
	Same	Letefoho	408m	September	November

Table 36. Irrigated rice: signs for planting (first season)

District	Village	Elevation	Sign for planting irrigated rice
Aileu	Seloi kraik	1077m	Water for irrigation relies on spring or river water
Manufahi	Betano	2m	Water for irrigation relies on spring or river water
	Lete foho	408m	Water for irrigation relies on spring or river water
	Dotik	20m	Plant after heavy rain has fallen for 1 week
Liquica	Gugleur	78m	Plant after heavy rain has fallen and saturated the ground
Baucau	Vemase tasi	255m	Water for irrigation relies on spring or river water
	Loilubo	770m	Water for irrigation relies on spring or river water
	Buroma	7m	Plant after rain has fallen for 2-3 weeks

Of the eight respondents interviewed who planted rice in the first season (to coincide with the wet season), three lowland respondents (Dotik, Gugleur, Buroma) relied on rainfed irrigation, planting rice after rain had fallen for several weeks and had saturated the ground. Note that in definitional terms, rainfed rice planted in lowland areas can not be categorised as irrigated rice, however it is included in this section based on respondents' definition of lowland rainfed rice as irrigated rice. (Harry, is this ok: or does lowland rainfed rice have to be included in the other section even though the farmers themselves define it as irrigated rice?) The remaining respondents relied on either spring or river-fed irrigation. In terms of second season planting of irrigated rice, farmers in Betano and Letefoho rely on springs and rivers fed by the second rainy season on the south coast.

3.2 Cultivating irrigated rice

Preparation of the irrigated ricefield

Eight out of seventeen farmers interviewed across the four districts planted irrigated rice varieties. While the post-harvest activities are virtually identical, the order of activities prior to planting vary according to location. This could be due in part to the fact that some farmers elaborated as many as 30 steps of cultivation while others elaborated as few as 10. As a result, some may have mentioned the timing for the activity of flooding and draining the ricefield, while others may have omitted to mention this. Some activities occur at different times e.g., flooding the ricefield takes place after planting in Woelakama, and before planting in most other areas. Additionally, a second phase of puddling the ricefield by buffalo or horse takes place in Woelakama and Loilubo (Baucau), while in Sarin (Aileu), farmers hoe the wet soil with *enxada* to break it up further.

The sequence depicted in Diagram 4 below represents the general pattern of cultivation for irrigated rice based on the data from eight rice farmers located in Aileu (Seloï kraik, Sarin), Baucau (Woelakama, Buroma, Loilubo), Liquica (Gugleur), and Manufahi (Letefoho, Betano).

Diagram 4. General pattern of the sequence of irrigated rice cultivation activity

- ⇒ repair/dig irrigation channel
- ⇒ prepare bunds
- ⇒ flood ricefield
- ⇒ puddle ricefield using buffalo or horse
- ⇒ propagate rice seedlings
- ⇒ make ricefield shelter as resting place for farmers
- ⇒ transplant seedlings into ricefield
- ⇒ weed bunds, irrigation channels, and ricefield
- ⇒ control for finches and animals
- ⇒ second weeding
- ⇒ drain ricefield
- ⇒ cut rice
- ⇒ prepare tarpaulin
- ⇒ thresh rice
- ⇒ clean rice stalks
- ⇒ winnow husk from grain
- ⇒ store rice

Generally speaking, ricefield preparation involves preparing the soil by slashing weeds and repairing the bunds and irrigation channels, followed by one or two episodes of flooding and ‘puddling’ (Tetum: *halai natar*) the ricefield using buffalo, and much less frequently, horses. In some places, rice seed is prepared using a soaking method, then seedlings are raised for transplanting directly into the ricefield after 30 days. Following planting, weeding of the bunds, channels, and ricefield is carried out. For the duration of the time between planting and harvest, rice farmers control for birds and rats, and continue weeding the ricefield, bunds, and irrigation channels. Post-harvest activities are uniform across all respondents and follow the same pattern as upland rice: cut ⇒ thresh ⇒ clean ⇒ winnow ⇒ store.

In most areas, irrigated ricefields are not fallowed. The exceptions are Seloï kraik (after 1-2 years of cropping the ricefield is fallowed for 2-3 years), and Buroma (every second year the ricefield is fallowed).

Selection and germination of rice seed

Depending on the location, grain is selected from a sheath with long flowers or branches at various times (cutting or harvesting the rice, cleaning the rice stalks, or drying the rice). Rice grain selected as seed for planting has the following characteristics: large, round-shaped, and clean.

In order to germinate the seed and accelerate root growth prior to broadcasting, farmers may soak and bury the seed. In Aileu (Sarin, Selo kraik) and Baucau (Woelakama, Loilubo), seed is soaked in water for 24 hours before removing and burying in a hole for two days. In Sarin, the rice seed is dried prior to soaking in water for one day, then placed in a hole and covered with leaves that have been previously dried and burned in the same hole. In Woelakama, rice seed is soaked for three days and then stored in a sack or pandanus mat, before being removed and covered with leaves, and then left for some days until the seed has produced roots. In Loilubo, after being soaked, the seed is placed in a sack and dried a little, before being wrapped firmly in dried leaves (Tetum: *ai tahan matak*). All farmers interviewed raised rice seed as seedlings before transplantation.

In Liquica (Gugleur) and Baucau (Woelakama, Loilubo), respondents flooded the place for raising seedlings prior to broadcasting. In Buroma, the respondent used buffaloes/cows to puddle the place for raising seedlings then flooded it before broadcasting the seed. Broadcast seed was left for as many as 30 days prior to transplantation into the ricefield (Loilubo). Farmers tend to transplant 2-3 seedlings in each hole depending on the size of the seedling. There was no correlation between area or elevation, and type of planting (rows or arbitrary). Respondents in Aileu district (Sarin, Selo kraik) only planted rice in rows using string for alignment. Respondents described arbitrary planting as 'traditional', contrasting aligned planting.

Irrigation methods

75% of farmers preferred to keep the ricefield continuously wet, draining only at harvest time (Loilubo, Buroma, Gugleur, Letefoho, Sarin, Selo Kraik). It was claimed that a wet ricefield meant softer soil during the growing period (Selo kraik, Gugleur), and presumably a higher yield. 25% of farmers (Woelakama, Betano) preferred to drain the ricefield during the growing period, and re-flood after drying because of waterlogging that affected some varieties not suited to growing in flooded conditions.

Table 37. Irrigated rice: irrigation method by village

Village	Elevation	Explanation of irrigation method
Selo kraik	1077m	Flood the ricefield to make the soil soft until the time of harvest
Sarin	935m	Keeping the ricefield wet will produce better yields
Betano	2m	Some varieties adapt to wet conditions and some do not. It is better to re-flood the ricefield when it has dried
Letefoho	408m	Keep flooding the ricefield from the time of planting and ripening, and drain the water at the time of harvest only
Gugleur	78m	Keep flooding the ricefield from the time of planting until harvest in order to make the soil soft
Woelakama	255m	If the ricefield is continuously wet, it will have a negative impact and may waterlog the rice
Buroma	7m	Keep the ricefield wet, drain at harvest time
Loilubu	770m	Keep the ricefield wet, draining at harvest time

Weeding

Weeding is carried out in the areas of the irrigation channel, bunds, and ricefield. Farmers use digging sticks to dig, and their hands to pull out weeds growing inside the paddy, and may heap the weeds or flatten and press the weeds into the ground to reduce new growth. The weeds growing on bunds are slashed using a machete to prevent snakes from hiding in the long grass. Weeding paddy and slashing bunds is usually undertaken by predominantly male or mixed household groups, or mixed mutual labour groups. Irrigation channels feed neighbouring ricefields and are a communal resource, and therefore, weeding is done predominantly by mutual labour groups, or neighbours may combine their labour or other resources (rice seed, buffalo, ricefield) to assist each other. This latter arrangement is known as *sosi*.

3.3 Religious rituals for irrigated rice

Like upland rice, religious rituals are integral to the cultivation cycle for irrigated rice. All respondents performed on average 2-3 rituals during the course of cultivating irrigated rice, with some performing as many as four. Objects of sacrifice are identical to rituals associated with upland rice, only the list of prescribed objects for irrigated rice also includes eggs, rice, and tobacco. The particular sacrifice is prescribed depending on the ritual. The sacrifice functions to invoke or call upon the protection of the ancestors and God against the risk of accident or misfortune such as: disease in the livestock used for puddling the ricefield; pestilence damaging the rice crop; loss of rice during the journey from the ricefield to the main house for storage, and loss or wastage of rice during the activity of gathering in the rice sheaths and during the process of threshing. Several rituals also gave thanks for adequate water for irrigation purposes, and for the harvest obtained.

Data about religious rituals in the cultivation cycle of irrigated rice was gathered across the four districts. Rituals performed prior to planting and prior to threshing were most common, followed by rituals performed prior to harvest. While the range of ritual activity is similar for both upland and irrigated rice, the following points are worthy of further study. First, no pre-threshing rituals were performed by respondents growing upland rice, yet this was the most commonly held ritual for irrigated rice. Second, rituals are performed to enable consumption of new (upland) rice, while consumption of irrigated rice attracts no such ritual.

Those rituals that are generally common to all places are held pre-cultivation, at the time of gathering the harvested sheaths in the ricefield, and when threshing the rice. A comprehensive list of rituals performed by study respondents during the cultivation cycle follows:

- during paddy preparation/after clearing irrigation channels
- immediately before planting
- after planting
- when the rice is growing vigorously
- before harvesting
- before gathering up the rice sheaths
- before threshing
- after threshing
- before storing the rice
- after storing the rice

Several observations can be made about the relation between the type of ritual, and who leads and attends that ritual. First, in any one place there is no variation in relation to who leads the ritual. For example among respondents in Loilubo, Buroma and Letefoho, all rituals are led by the head of the household only, whereas in Seloikraik, Sarin, Gugleur and Letefoho, all rituals are led by a ritual elder only. The mutual labour arrangement of '*sosi*' influences ritual in some places (e.g., Betano) where it is the buffalo owner who carries out the pre-ploughing ritual, and the ricefield owner who carries out the pre-harvesting ritual. Unlike maize, among the irrigated rice respondents in this study, no ritual performance engaged members households of the ritual house. Instead, larger-scale rituals involved neighbouring ricefield households and extended family.

Table 38. Irrigated rice: religious rituals associated with cultivation by village

Village	Local language	Name of ritual (local language)	Time of ritual	Object of sacrifice	Objective of the ritual
Seloi kraik	Mambae	1. Antes dei mea (antes=before, dei=to plant, mea=rice) 2. Fois mea laun (fois=to place, mea=rice, laun=on top) [in this context, the head of one rice plant is chosen for cutting and the head and grain placed on top of the sacred stone as a symbol that the harvest of the entire rice crop will now commence, and that the remaining sheaths will similarly yield such grain] 3. Sam mea (sam=thresh, mea=rice)	1. Before planting rice 2. Rice growing vigorously, before the harvest (March) 3. Before threshing	1. Pig, goat, chicken 2. Pig, chicken, coconut 3. Pig, chicken	1. To seek protection for the crop from the ancestor 2. To enable vigorous growth of the rice 3. To give thanks
Sarin	Mambae	1. Tuk lisensa (tuk=request, lisensa=permission) 2. Ne agradece (ne=to give, agradece=thanks)	1. Before preparing the rice field 2. After harvesting rice	1. Areca nut and betel leaf 2. Pig, goat, chicken	1. To ask permission to open a new rice paddy 2. To give thanks for the harvest
Betano	Mambae	1. Ha'as arbou oen (has=to wash/flood, arbou=buffalo, oen=ain) 2. Cermonia boul sauna (boul=to cut, sauna=rice)	1. Before ploughing/puddling the ricefield 2. Harvesting rice	1. Goat or pig 2. Pig or chicken	1. To prevent buffaloes/cows [used for puddling] from disease and death, and to guard against water shortage 2. To obtain greater yields
Letefoho	Lakalei	1. Uma hukun susar anan (uma=house, hukun=sacred, susar=troubles in the context of agriculture, anan=child) [in this context, farmers are the children of the deceased ancestors and ritual house members, and they call on the ancestors to hear and see their troubles] 2. A hukun (hukun=sacred)	1. Before planting rice 2. Missing data	1. Chicken, pig, rice 2. Chicken, pig, beverage, areca nut and betel leaf, tobacco, rice	1. To seek the protection of the rice crop from the spirit custodian (<i>rai nain</i>) 2. To give thanks to the spirit custodian (<i>rai nain</i>)
Gugleur	Tokodede	1. Kuersa karbau koer (kuersa=to wash, karbau=buffalo, koer=feet) 2. Lode biti (lode=to install/nahe, biti=mat woven from palm leaf) 3. Dok resa (dok=to carry, resa=rice)	1. Before planting rice 2. Before threshing 3. At the time of carting the rice	1. Pig or goat 2. Pig or goat 3. Chicken	1. To guard against pestilence and disease in buffaloes and cows [used for puddling] and in the rice plants 2. To guard against loss of rice grains at the time of threshing, and to even increase the yield 3. To protect rice that is being transported to the house for storage against disaster
Woelakama	Waimua	1. Berloi (berloi=to celebrate) 2. Daku se'e (daku=to thresh, se'e=hare) 3. Daku se'e	1. Before threshing 2. Before gathering up the sheaths of rice 3. After gathering up the rice	1. Pig, goat, chicken, areca nut and betel leaf 2. Betel leaf 3. Goat and chicken	1. To guard against loss of rice grains at the time of threshing 2. To guard against loss of rice at the time of gathering up the sheaths 3. Give thanks prior to storing the rice
Buroma	Makassae	1. Umura fa'ana (umura=forefathers, fa'ana=to give food) 2. Resa sagiara (resa=rice, sagiara=to thresh)	1. ?After cleaning the irrigation channel 2. At the time of threshing the rice	1. Goat, pig, areca nut and betel leaf, rice 2. Goat, chicken, eggs, rice	1. ? Give thanks for sufficient water for irrigation 2. Give thanks to the ancestor
Loilubu	Waimua	1. Rusu waihasa 2. Dare see mori/rai lhubu/dubu (rai=to place, lhubu=leaf tip) 3. Rusu wai hasa 4. Ama gia (ama=owner/male i.e., Tetum:nain/mane, gia=install) 5. Ama gia	1. Before planting 2. Before cutting the rice (harvest) 3. Before threshing the rice 4. missing data 5. Before gathering the rice sheaths 6. After gathering the rice sheaths	1. Eggs, rice 2. Eggs, rice 3. Fetch the objects of sacrifice that were left on the sacred rock (Tetum: fatuk belar) during the previous pre-harvest ritual	1. Call for ancestor's attention to protect the rice field 2. Give thanks to the ancestor for rice ready to harvest 3. missing data 4. missing data 5. missing data

		6. Ama gia		(i.e., eggs, rice) 4.missing data 5.missing data 6.missing data	6.missing data
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Table 39. Irrigated rice: leadership and participation in religious rituals by village

Suco/Village	Local language	Name of ritual (local language)	Time of ritual	Person who leads the ritual	Household/s participating in the ritual
Seloi kraik	Mambae	1. Antes dei mea (antes=before, dei=to plant, mea=rice) 2. Fois mea laun (fois=to place, mea=rice, laun=on top) 3. Sam mea (sam=thresh, mea=rice)	1. Before planting rice 2. Rice growing vigorously (March) 3. Before threshing	1. Ritual elder (Tetum:lia nain) 2. Ritual elder 3. Ritual elder	1. Approx. 4-5 households 2. Approx. 4-5 households 3. Approx 10-15 households
Sarin	Mambae	1. Tuk lisensa (tuk=request, lisensa=permission) 2. Ne agradece (ne=to give, agradece=thanks)	1. Before preparing the rice field 2. After harvesting rice	1. Ritual elder 2. Ritual elder	1. The farmer's household and the ritual specialist only 2. A group of farmers whose ricefields share boundaries or are proximate
Betano	Mambae	1. Ha'as arbou oen (has=to wash/flood, arbou=buffalo, oen=ain) 2. Cermonia boul sauna (boul=to cut, sauna=rice)	1. Before ploughing/puddling the ricefield 2. Harvesting rice	1. The buffalo owner 2. The landowner	1. The buffalo owner and those households that used his buffalo to plough their ricefield 2. 7-8 households
Letefoho	Lakalei	1. Uma hukun susar anan (uma=house, hukun=sacred, susar=susar, anan=child) 2. A hukun (hukun=sacred)	1. Before planting rice 2. missing data	1. The landowner 2. The landowner	1. 5-6 households 2. 5-6 households
Gugleur	Tokodede	1. Kuersa karbau koer (kuersa=to wash, karbau=buffalo, koer=feet) 2. Lode biti (lode=to install/nahe, biti=mat woven from palm leaf) 3. Dok resa (dok=to carry, resa=rice)	1. Before planting rice 2. Before threshing 3. Before storing rice	1. Ritual elder 2. Ritual elder 3. Ritual elder	1. All households in the ?village 2. All households in the village 3. Single household only
Woelakama	Waimua	1. Berloi (berloi=to celebrate) 2. Daku se'e (daku=to thresh, se'e=hare) 3. Daku se'e	1. Before threshing 2. Before gathering up the sheaths of rice 3. After gathering up the rice	1. Ritual elder 2. Ritual elder 3. Ritual elder	1. Approx 5-6 households 2. Extended family 3. Extended family
Buroma	Makassae	1. Umura fa'ana (umura=forefathers, fa'ana=to give food) 2. Resa sagiara (resa=rice, sagiara=to thresh)	1. After cleaning the irrigation channel 2. Before gathering up the sheaths of rice	1. missing data 2. Head of the household	1. missing data 2. The farmer (one person only not the household)
Loilubu	Waimua	1. Rusu waihasa 2. Dare see mori/rai lhubu/dubu (rai=to place, lhubu=leaf tip) [in this context, the head of a rice plant is cut and placed on a sacred stone first, and then the rice harvest commences] 3. Rusu wai hasa 4. Ama gia (ama=owner/male i.e., Tetum:nain/mane, gia=install) 5. Ama gia 6. Ama gia	1. Before planting 2. Before cutting the rice (harvest) 3. Before threshing the rice 4. missing data 5. Before gathering the rice sheaths 6. After gathering the rice	1. The farmer i.e., the head of the household 2. The farmer i.e., the head of the household 3. The farmer i.e., the head of the household	1. The farmer (single household) 2. approx. 6-7 households 3. approx. 6-7 households 4. approx. 6-7 households 5. approx. 12-15 households 6. approx. 12-15 households

			sheaths	4. The farmer i.e., the head of the household 5. The farmer i.e., the head of the household 6. The farmer i.e., the head of the household	
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3.4 Division of labour for irrigated rice

Farmers cultivated irrigated rice as members of mutual labour groups and/or household groups.

Mutual labour exchange

Mutual labour exchange groups used for irrigated rice may include members of the same group that rotated in each other's gardens to cultivate maize, as well as neighbours who have ricefields. Mutual labour exchange groups for cultivating irrigated rice are larger than maize groups, for example, as many as 50 people in Gugleur, and 30-40 people in Woelakama. Proximity is what brings members of a group together, and members have different size ricefields.

Whether a farmer uses a household group or mutual labour group depends on the labour availability at the level of the household in relation to the size of a farmer's ricefield. Each of the eight farmers from four districts interviewed used mutual labour groups for cultivating irrigated rice. Activities undertaken by mutual labour groups include: ricefield preparation and planting (75% of respondents), weeding and threshing (60% of respondents), harvesting rice (50%), transplanting (40%), puddling (30%), and winnowing (25%). Note that while planting was carried out by mutual labour groups in 75% of respondents, the figure for transplanting was only 40% with mixed households carrying out the same proportion of transplanting. Additionally, one respondent also stated that they used *either* household or mutual labour groups for the activities of puddling, planting, weeding and harvesting.

The result reflects the level of labour input required for many activities associated with the cultivation of irrigated rice, namely, ricefield preparation, planting, weeding, harvesting, and threshing. It also demonstrates the extent of mutual labour group co-operation across at least four main activities in the cultivation cycle for irrigated rice. The institutionalization of mutual labour exchange for cultivating irrigated rice has implications for adoption of SoL varieties; offering an existing network for distributing new varieties.

Table 40. Irrigated rice: activities carried out by mutual labour groups

Commodity	Number of farmers	Field preparation	Transplanting	Weeding	Threshing	Harvesting
Irrigated rice	8	75%	75%	60%	60%	50%

It should be clarified that the process of preparing the ricefield involves several activities (bund repair and weeding, irrigation channel repair, ricefield weeding and burning etc.), each of which may utilise a different formation such as mixed household, male-only household, mutual labour, or *gotong royong* - an Indonesian term describing a non-rotational labour form that tends to involve public or communal property. Such activities include digging out, cleaning and weeding shared irrigation channels.

'*Sosi*' or sharecropping is a type of mutual labour arrangement practiced by most irrigated rice farmers in this study (except Betano). With this system, a land-owning farmer and a buffalo owner may share resources to produce a rice crop and then share the harvest equally. There are many possible variations:

- One partner provides buffalo and/or ricefield, the other partner provides rice seed (Sarin, Gugleur, Letefoho)
- One partner provides the ricefield and the other partner provides the labour (Seloikraik)
- One partner provides the ricefield and the other partner provides buffalo or tractor (Buroma, Woelakama, Loilubo)

Mixed household group

Household groups may be mixed, or gender-restricted. In the context of cultivating irrigated rice, nuclear household groups carry out non-labour intensive activities, while labour-intensive activities draw more widely on members from the extended family such as sons-in-law. Those activities undertaken by mixed household groups include: propagating seedlings (100% or 7 respondents), controlling for birds (85% or 6 out of 7 respondents), storing (75% or 6 out of 8 respondents), weeding (up to 42% including 1 respondent

who used *either* mixed household or mutual labour grouping), transplanting (42% or 3 out of 7 respondents), puddling the ricefield (up to 42% or 3 out of 7 respondents including 1 respondent who used *either* mixed household or mutual labour grouping), winnowing (37% or 3 out of 8 respondents), preparing the ricefield (up to 37% or 3 out of 8 including 1 respondent who used *either* mixed household or mutual labour grouping), threshing (12% or 2 out of 8 respondents), and cutting and planting (each up to 12% or 2 out of 8 respondents including 1 respondent who used *either* mixed household or mutual labour grouping).

Table 41. Irrigated rice: activities carried out by mixed household groups

Commodity	Number of farmers	Garden/ricefield preparation	Propagate seedlings	Planting	Weeding	Controlling for birds	Harvesting	Threshing	Storing
Irrigated rice	8	Up to 42%	100%	Up to 12%	Up to 42%	85%	Up to 12%	12%	75%

Gender-restricted household groups

For almost all gender-restricted activities, men will assist women and women will assist men where there is insufficient labour. The extent to which activities associated with irrigated rice are gender-restricted are fairly similar to upland rice, with the most obvious exception being Selo kraik where many of the main activities are gender-restricted. While activities were undertaken by men-only household groups in all locations except Buroma and Letefoho, the only clear pattern of male-only activity across all suco occurs for managing the process of irrigation, that is, flooding and draining the ricefield. Activities undertaken by women-only household groups include storing rice (25%), and transplanting and winnowing (each 12%).

Table 42. Irrigated rice: activities carried out by women-only household groups

Commodity	Number of farmers	Transplanting	Winnowing	Storing
Irrigated rice	8	12%	12%	25%

Strictly gendered activities apply to irrigated rice only, and are confined to several activities in a few locations only. For example, in Loilubo and Gugleur, men only prepare the bunds for irrigated rice because the task is considered to be too heavy for women. In Gugleur, women only tend to winnow rice as it is believed that if men assist winnow, the rice will decrease in quantity during the process of winnowing. In Selo Kraik, men only may thresh rice as it is believed women will cause the rice to become less.

3.4 Irrigated rice varieties

Table 43. Variety table for irrigated rice, by village

District	Village	Elevation	Name of variety (local language)	Other name mentioned (Tetun and/or English)	Length of time planted	Colour of rice seed (hulled)	Reason for growing this variety	Duration planting until harvest
Aileu	Sarin	935m	1. Mea loban (Mambae) 2. Mea tuun naton 3. Mea tuun	1. Rice 64 2. Rice 54 3. Hare batang suami (Husband's sheath)	1. Since Indonesian times 2. SOL distribution (2006) 3. Since Indonesian times	1. White 2. White 3. White	1. Early harvest 2. Want to try new variety (greater yield, earlier harvest) 3. This variety has long stems, and if you plant three seedlings in one hole they will produce 60-70 stems	1. 3-4 months 2. 3 months 3. 4-5 months
	Seloi kraik	1077m	1. Mea fulon (Mambae) 2. Mea ai foe huan 3. Mea meran 4. Mea blokon	1. Hare fulon 2. Hare ai bubur musan 3. Hare mean (red rice) 4. Hare badak (short rice)	1 & 2 & 3. Since the time of our ancestors 4. Since Indonesian times	1. White 2. White 3. Red 4. White	1. Can plant in area close to water source. 2. Early harvest when planted in upland soil 3. Fragrant to eat 4. Early harvest even when lack of rain fall	1. 5 months 2. 4 months 3. 4 months 4. 3 months
Baucau	Buroma	5m	1. Resa membron (Makassae) 2. Resa IR-8 3. Resa silaun	1. Hare Membron 2. Hare IR-8 3. Hare silaun	1. Since the time of our ancestors 2. missing data 3. Since Portuguese times	1. Red, white 2. White 3. White	1. Does not fall over when ripe 2 & 3. Good rain fall will produce better yield	1. 4 months 2. 6 months 3. 6 months
	Loilubo	770m	1. Silaun (Waimua) 2. Kaidile 3. Buogio 4. Lakuresa 5. Ekursava 6. Atana 7. Singapura 8. Okomuni 9. IR 8 10. Sulai 11. Lalu rua 12. Aulaku 13. Kaidaba resa 14. Moko	1. Silaun 2. Kaidile 3. Buogio 4. Lakuresa 5. Ekursava 6. Atana 7. Singapura 8. Okomuni 9. IR 8 10. Sulai 11. Lalu rua 12. Aulaku 13. Kaidaba resa 14. Moko	1-6. Since the time of our ancestors 7. From Singapore 8. Since the time of our ancestors 9. Since Portugues times 10-14. Since the time of our ancestors	1. White 2. White 3. Red 4. Red 5. White 6. White 7. White 8. White 9. White 10. White 11. White 12. White 13. Red, white 14. White	1-10. For daily consumption 11. For conducting sacred ritual 12-14. For daily consumption	1. 5-6 months 2. 5-6 months 3. 5-6 months 4. 4 months 5. 5-6 months 6. 5-6 months 7. 5-6 months 8. 7 months 9. 7 months 10. 5 months 11. 6 months 12. 6 months 13. 6 months 14. 7 months

Table 43. Continued

District	Village	Elevation	Name of variety (local language)	Other name mentioned (Tetun and/or English)	Length of time planted	Colour of rice seed (hulled)	Reason for growing this variety	Duration planting until harvest
	Woelakama	255m	1. Se'e IR-8 2. Se'e Singapur 3. Se'e IR-5 4. Se'e Kaidila 5. Se'e Amerika 6. Se'e Silaun	1.Hare rai nain IR-8 2.Hare Singapure 3. Hare Ir-5 4. Hare Aidila 5.Hare Amerika 6. Hare Silaun	1. Since the time of our ancestors 2.From Singapore 3. Since 1973 4. Since the time of our ancestors 5. Since 1981 6.Since the time of our ancestors	1.White 2.White 3.White 4.Red, white 5.White 6. Mustura (mix of red and white)	1. Does not fall over when ripe 2.Want to cultivate this variety in our country, and because its rice gabah is better 3. Does not attract birds when ripe, and does not fall over in strong winds 4. Used for sacred rituals 5. Early ripening 6.Withstands mixed planting	1. 3 months 2. 6 months 3. 3 months 4. 6 months 5. 2 months 6. 6 months
Liquica	Gugleur	78m	1. Resa buti (Tokodede) 2. Resa mega 3. Resa meta 4. Resa turu	1. Hare mutin 2. Hare kinur 3. Hare metan 4. Hare badak	1-3. Since the time of our ancestors 4.Since Indonesian times	1.White 2.White 3.Black 4.White	1 & 2. Large seed, good quality 3. Fragrant when cooked as porridge 4. Early ripening	1. 4 months 2. 4 months 3. 4 months 4. 3 months
Manufahi	Betano	2m	1. Membrano 2. Nona Portu 3.Meapresidente	1.Hare Membramo 2.Hare Nona Portu 3.Hare presidente	1. 10 years (1996) 2. 2 years ago (2004) and not planted until now 3. 10 years (1996)	1.White 2. White 3. White	1. Sweet taste (does not need vegetables) 2. Disease-free, does not attract rats 3. Disease-free, good seed	1. 3 months 2. 3 months 3. 3 months
	Letefoho	408m	1. Are mubina (Laklei) 2. Are Meten 3. Are ai dauk	1. Hare kuda tasak 2. Hare metan 3. Hare ai dak	1-3. Since the time of our ancestors	1.White, red 2.Black 3.White	1. Fragrant 2. Fragrant 3. Fragrant	1. 3 months 2. 3 months 3. 3 months

The eight irrigated-rice farmers interviewed grew at least 3-4 different varieties of irrigated rice every year, with the respondent in Woelakama growing 6 varieties. The respondent in Loilubo mentioned 14 varieties ever grown, but planted only 4 of these annually. Each respondent planted a selection of varieties each with different qualities. Some respondents however selected for the same characteristics across several varieties, suggesting particular vulnerability in that location, for example, wind resistance (Woelakama).

An open-ended question was used to elicit the positive characteristics of each variety of irrigated rice planted. Characteristics mentioned can be categorised as follows: fragrance, early harvesting, wind resistance, large-sized grain, disease resistance, and ceremonial purposes.

- Fragrance. 60% of respondents mentioned fragrance in 6 varieties planted. Different respondents viewed different varieties to be fragrant: red rice (Selo Kraik and Letefoho), black rice (Gugleur and Letefoho), mixed red and white rice (Letefoho), and white rice (Letefoho). Additionally, white Membrano rice was mentioned as sweet to taste (Betano).
- Early harvest. 50% of respondents mentioned early harvesting in 6 varieties planted. Those varieties mentioned as early harvesting were: Rice 64 (3-4 months) and 54 (3 months) in Sarin, the white rice mentioned as American rice or 'Hare Amerika' (2 months) in Woelakama, the white rice mentioned as 'hare ai bubur musan' (4 months) grown in Selo kraik, and the short-length white rice variety mentioned as 'hare badak' (3 months) in Gugleur and Selo kraik. This last variety grown in Selo kraik was said to harvest early even in conditions of inadequate rainfall.
- Wind resistance. 25% of respondents (2 farmers from Baucau district) mentioned wind resistance in 3 varieties planted, with the respondent from Woelakama mentioning 2 out of 6 varieties grown as wind resistant (presumably selected for this characteristic). Wind-resistant varieties planted included 'Membron' (Buroma), and 'IR-8' and 'IR-5' (Woelakama).
- Yield. 25% of respondents mentioned good yield as characteristics of 4 varieties planted: IR-8 and the white-grained 'Silaun' (Buroma), and 'IR-54' and the white-grained 'hare batang suami' (Aileu). Large grain was also mentioned by 1 respondent (Gugleur) for the following varieties: white 'hare mutin' and white-grained 'hare kinur'.
- Disease resistance. One respondent (Betano) mentioned disease resistance in 2 varieties planted: the large, round, white variety mentioned as 'hare nona portu' and the white, narrow-grained variety mentioned as 'hare precedente'.
- Ceremonial use. Two respondents from Baucau district mentioned that they grew single varieties for ceremonial purposes: a red, long-grained variety mentioned as 'hare ai dila' (Woelakama), and a white rice known as 'lala rua' (Loilubo).

4. Sweet potato (Tetum: fehuk midar)

Sweet potato (*Ipomoea batatas*) is a widely grown food crop (or species) among small holder farmers in Timor, principally as a secondary food crop. It is typically intercropped with other staples and has been cultivate in Timor for centuries (Cinatti 1964:182).

Cultivation of sweet potato is considered to be environmentally friendly because of the low inputs required, especially for nitrogen, and its ability as a fast-growing crop to cover the land and prevent erosion. It has a unique ability to grow on marginal lands, under shady conditions and is an ideal ground cover for inter-cropping (Jayasinghe et al 2003). For these and other reasons such as its value as a food security crop, its high nutritious value and its utility in subsistence cropping regimes and its potential commercial value, sweet potato has been a focus for SoL varietal testing.

4.1 Planting Times

Table 44. Sweet potato: first season planting times by village

Distrito	Sub-district	Suco	Elevation	Time of first season planting	Time of first season harvest
Aileu	Aileu	Sarin	935m	Between August and October	November
	Aileu	Seloi kraik	1077m	November	May
	Liquidoe	Manucasa	1363m	November	May
Baucau	Baucau	Garuwai	680m	November to December	April to May
	Baucau	Buroma	2m	(second season harvest only)	
	Vemasse	Loilubo	770m	November to December	April to May
	Vemasse	Vemasse tasi	225m	December	March
Liquica	Liquica	Daru Leten	1241m	(second season harvest only)	
	Liquica	Dato	34m	January (<i>kantadeiro</i> or raised bed) February to March (main garden)	March (raised bed) June (main garden)
	Maubara	Gugleur	78m	November	July
	Maubara	Maubaralisa	998m	December	October
Manufahi	Alas	Dotik	20m	November to December	March to April
	Alas	Mahakidan	20m	December to January	August to September
	Same	Letefoho	408m	November to December	May

Table 45. Sweet potato: second season planting times by village

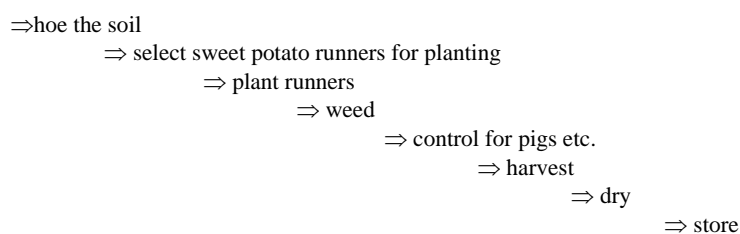
District	Sub-district	Village	Elevation	Planting	Harvest
Baucau	Baucau	Buroma	2m	June to July (plant in the ricefield after harvesting irrigated rice)	September
	Baucau	Garuwai	680m	June	August to October
	Vemasse	Loilubo	770m	April to May	December to February
	Vemasse	Vemasse tasi	225m	June	September to October
Liquica	Liquica	Daru Leten	1241m	March	July
Manufahi	Same	Letefoho	408m	April to May	August

Of those 14 farmers interviewed who planted sweet potato, 5 planted two crops per year. All farmers who planted sweet potato at the end of the dry season (around November), planted after rain had fallen for several days and had saturated the soil, and after the maize had been planted. The second crop is planted at the beginning of the annual dry season in Baucau district, and during the second short rainy season on the south coast. To compensate for the dry conditions on the north coast, farmers in Baucau tend to irrigate their second season crop. In Garuwai and Loilubo, gardens were watered (Tetum: *rega*) prior to planting to soak the soil and after planting: twice weekly for five months in Loilubo, and daily watering during the first week only in Garuwai. The respondent from Dato (34m) sought to maximise his sweet potato harvest by growing two crops of sweet potato using different systems: one crop located in his lowland garden planted in a raised bed (Tetum: *kantadeiro*) watered by hand, and one crop in an upland garden location.

4.2 Activities related to sweet potato cultivation

The pattern for planting sweet potato across all districts comprises approximately eight steps.

Diagram 5. General sequence of cultivation activity for sweet potato



In one coastal area (Dato, 9m) a respondent cultivated sweet potato in a raised bed (Tetum: *kantadeiro*) in his house garden by heaping soil. The *kantadeiro* did not require hand-watering as planting was carried out in January, during the wet season. The same respondent also planted sweet potato in his main garden located at a significantly higher elevation.

Another respondent (Letefoho) heaped soil over the sweet potato plant when the tuber began to break through the surface of the soil prior to harvest.

Selection of sweet potato runner

In order to obtain good yields, all farmers interviewed selected for the same characteristics in runners: length, age (neither too old nor too fresh), and good leaf nodes (Tetum: *fukun*). In terms of length, some farmers (Manucasa, Letefoho) cut stems that were approximately finger to elbow in length. Most respondents selected runners with certain numbers of leaf nodes, on average about 4, with as many as 8-10 selected in Daru Leten (elevation 1241m). Most farmer planted only one runner per hole, with two farmers from Baucau district planting 2, and one farmer in Maubaralisa (elevation 998m) planting 3-4 runners in each hole.

In Mahakidan, farmers do not plant sweet potato cuttings, rather they plant a tuber which they have split into two. They refer to this species as ‘fehuk kumbile’ or the sweet potato yam.⁷

Table 46. Sweet potato: planting method by village

Village	Number of buds	Number of runners planted in each hole
Seloi kraik	4-6	1
Lausi	4-5	1
Manucasa	3-4	1
Lete foho	3-4	3-4
Mahakidan	8 (50-60cm)	2-3
Dotik	4-5	2-3
Dato	4-5 (30cm runner)	1
Daru leten	8-10 (30-85cm runner)	1
Maubara lisa	40cm runner	4-5
Gugleur	4 (40cm runner)	1
Vemase tasi	4-6	2
Gariwai	4	1
Loilubo	4-5	2

Planting

Farmers use digging sticks made from either wood or iron to dig the hole for planting, and usually the hand is used to cover the hole over. In three locations (Sarin and Seloi kraik in Aileu district, and Dato) the hole is left open.

The number of runners planted in each hole differ from place to place, and there is no correlation between number of runners and elevation.

- 1 runner only is planted throughout Aileu district and Liquica district (Dato, Daru leten)
- 1-2 runners in Liquica district (Gugleur) and Baucau (Garuwai)
- 2 runners in Baucau (Loilubo, Buroma)
- 3 runners in Manufahi (Letefoho)
- 4-5 runners in Liquica (Maubara lisa)

Table 47. Sweet potato: planting distances by village

Village	Planting distance ⁸
Sarin	30-40cm
Seloi kraik	25cm
Lausi	20-25cm
Manucasa	20-25cm
Lete foho	50cm-70cm
Mahakidan	40cm-45cm
Dotik	1m
Dato	20cm
Daru leten	10-15cm
Vatuvou	20cm
Maubara lisa	40-60cm
Gugleur	1m
Vemase tasi	10cm-15cm
Gariwai	30cm-50cm
Loilubo	1. 10cm for irrigated sweet potato grown in the (second) dry season

⁷ Also known as sweet yam, kumbili (*Dioscorea esculenta*) can be cultivated, or dug from the forest, and constitutes an important food for Timorese.

⁸ Tape measure was used by interviewers as reference measurement for respondent.

	2. 1m for sweet potato grown in the wet season
Buroma	20cm-30cm

Weeding

As a general rule, farmers slash the weeds using a sickle or machete, then dig the weed's root using a digging stick or small machete. In some places (Maubaralisa, Letefoho, Gugleur), weeds are heaped near to the sweet potato to decompose and become humus. Farmers undertake between one and three weeding activities for sweet potato with three phases of weeding carried out in Seloikraik, Garuwai, Gugleur and Maubaralisa. There is no correlation between the number of weeding activities and elevation. For sweet potato, the number of people carrying out the second and third weeding tend to be the same as the first weeding. This pattern contrasts maize where the first activity is undertaken by a mutual labour group and the second weeding is carried out by a smaller group comprising household members only. The reason for this is that unlike maize, mutual labour exchange groups are used by one-third of respondents only for weeding sweet potato, and mixed household groups are the dominant labour formation for sweet potato generally.

Table 48. Sweet potato: frequency of weeding by village

District	Village	Elevation	Total number of weeding activities	Number of people	Number of people	Number of people
Aileu	Sarin	935m	Once	2-3 people	n/a	n/a
	Seloikraik	1077m	Three times	5-10 people (mutual labour exchange: weed maize and sweet potato together)	4-6 people (mutual labour group)	4-6 people (mutual labour group)
	Manucasa	1363m	Twice	2-3 people	2-3 people	n/a
Baucau	Garuwai	680m	Three times	2-3 people	2-3 people	2-3 people
	Buroma	7m	Twice	4-5 people	4-5 people	n/a
	Loilubo	770m	Twice	4-5 people	4-5 people	n/a
	Vemasse Tasi	255m	Once	4-5 people	4-5 people	n/a
Liquica	Daru Leten	1241m	Once (because the runners act as a ground cover, smothering weeds)	4-5 people	n/a	n/a
	Dato	34m	Once (because the soil is turned over prior to planting)	3-5 people	n/a	n/a
	Gugleur	78m	Three times	10 people	4-5 people	4-5 people
	Maubaralisa	998m	Three times	2-3 people	2-3 people	2-3 people
Manufahi	Dotik	20m	Once	5-10 people (mutual labour group)	n/a	n/a
	Mahakidan	20m	Twice	5-10 people (mutual labour group)	4-5 people	n/a
	Letefoho	408m	Twice (if planted with maize, weed once only)	2-3 people	2-3 people	n/a

Digging out (harvesting)

When the maturing sweet potato causes the surface soil to break open, it signals that the sweet potato is ready to be harvested. The duration between planting and harvest depends on altitude (higher altitude lengthens maturity), the age of the garden, and whether sweet potato is grown alone, or intercropped. One respondent (Seloikraik) explained that sweet potato grown in a new garden usually takes 6 months only to

harvest, while sweet potato grown alongside maize takes 12 months. Sweet potato foliage is slashed using a machete and the tuber is dug out with a digging stick.

Table 49. Sweet potato: harvesting duration by village

Village	Elevation	Month that sweet potato is ready to be harvested	Month in which harvesting finishes	Duration of harvest
Sarin	935m	May	August to September	3-4 months
Seloi kraik	1077m	June	August to September	2-3 months
Manucasa	1363m	May	August to September	3-4 months
Garuwai	680m	June to July	September	2-3 months
Buroma	7m	September	December	3 months
Loilubo	770m	April to May	October	5-6 months
Woelakama	255m	June to July	August to October	2-3 months
Daru Leten	1241m	June to July	December	5-6 months
Dato	34m	May to June	July	1-2 months
Gugleur	78m	June to July	August to September	2-3 months
Maubaralisa	998m	August to September	October	1-2 months
Dotik	20m	July	September to October	2-3 months
Mahakidan	20m	July	September	2 months
Letefoho	408m	May	August to September	3-4 months

The duration of the harvest period for sweet potato tends to be longer in upland areas (between 4-6 months) and shorter in lowland and sloping areas (1-3 months).

Drying

Farmers may harvest and then dry sweet potato to store as food reserves during the hungry period (usually December until the new maize harvest in February). However, drying is only carried out if production is high. If yields are low, sweet potato is dug on demand for daily consumption only. Nine out of 13 respondents (70%) routinely dried sweet potato to become a food reserve. Those respondents who did not dry sweet potato were from Baucau District (Garuwai, Buroma) and Liquisa District (Daru lete, Dato, Maubaralisa). The respondent in Seloi kraik dried sweet potato in order to sell it during the hungry season (January-February). The process of drying was similar for all locations. Following harvest, the skin is removed and each tuber is chopped into several pieces for drying. For example, in Manucasa a large tuber is chopped into 3 or 4 pieces, and a small one is cut into 2 pieces only. The cut sweet potato is then laid in the sun to dry on mats (*biti*) woven from palm leaf, or nylon tarpaulin. In Gugleur, the respondent dried sweet potato on the roof of his house. One respondent, a Mambai speaker from Daru Leten, explained that local farmers do not dry sweet potato as it is believed that to do so will attract dangerous lightning during the wet season.

Storing

The purpose of drying sweet potato is to store it as a reserve food for a long period of time. The range of storage methods include: in a sack inside a 44-gallon drum; on a shelf or rack above the hearth; in a woven basket (Tetum: *hokan*); in a woven sack made from palm leaf (Tetum: *kaur*) and hanged from a shady tree. Storage methods are fairly uniform at the district level. In both Aileu and Manufahi districts, respondents stored sweet potato above the fire place and/or in a sack inside a large drum. In Mahakidan (Manufahi), the respondent hanged dried sweet potato in a woven sack from a shady tree. In Baucau district, respondents used woven baskets stored inside the main house.

4.3 Division of labour for sweet potato cultivation

Mixed household groups were the dominant labour formation for cultivating sweet potato. Mutual labour exchange was used by one-third of respondents for weeding only.

Mixed household group

Respondents used mixed household groups for the majority of activities associated with the cultivation of sweet potato, for example, planting (92% or 13 out of 14 respondents), weeding (up to 83% or 10 out of 12 respondents including 2 respondents who used *either* a mixed household group or a mutual labour group), harvest (75% or 9 out of 12 respondents), storage (87% or 7 out of 8 respondents), drying (83% or 5 out of 6 respondents), and runner preparation (45% or 5 out of 11 respondents).

Table 50. Sweet potato: activities carried out by mixed household groups

Commodity	Number of farmers	Seed/runner preparation	Planting	Weeding	Harvesting	Drying	Storing
Sweet potato	14	45%	92%	Up to 83%	75%	83%	87%

Gender-restricted household group

In several locations, activities undertaken by household groups were gender-restricted. The range of activities undertaken by women-only household groups include preparations of runners for planting (36% of respondents), harvesting (25% of respondents), and planting, drying and storing (1 respondent only). Preparing runners for planting was undertaken by women-only household groups in Letefoho, Mahakidan, Dotik, and Daru leten. Harvesting is undertaken *either* by mixed-household groups or household groups comprising mainly women in Dato, Gugleur, and Mahakidan. Harvesting may be undertaken intensively over a short period with the purpose of drying for storage, and may also be dug when required for daily consumption. Drying and storing tends to be undertaken by mixed-household groups, with women's household groups doing these activities in Gugleur and Mahakidan.

Table 51. Sweet potato: activities carried out by women-only household groups

Commodity	Number of farmers	Preparing seed/runners	Planting	Harvesting	Drying	Storing
Sweet potato	14	36%	7%	25%	7%	7%

The only activity undertaken by men-only household groups was preparation of runners in Gugleur and Garuwai.

Mutual labour exchange

Compared to maize and rice, mutual labour groups are seldom used in the cultivation cycle of sweet potato. Weeding was the only activity that utilised the mutual labour group in four out of 12 locations. In Manucasa and Dotik, the weeding of sweet potato is undertaken by mutual labour groups, and in Gugleur and Maubaralisa weeding is done by *either* mutual labour group or household depending on the labour availability in relation to garden size. Combining these two categories, it can be said that up to 33% or one-third of respondents used mutual labour groups to weed sweet potato.

Table 52. Sweet potato: activities carried out by mutual labour groups

Commodity	Number of farmers	Garden preparation	Planting	Weeding	Harvesting
Sweet potato	14	None	None	Up to 33%	None

4.4 Sweet potato varieties

Table 53. Table of sweet potato varieties, by village

District	Village	Name of variety (local language)	Name of variety (Tetun)	First planted	Colour of outer skin	Color of inner skin	Colour of flesh	Reasons for growing this variety	Duration planting until harvest	Duration can remain in soil before decomposition
Aileu	Sarin	1.Uhlae butin (Mambae) 2.Uhlae meran 3.Uhlae karen 4.Uhlae forlaun	1.Fehuk konko mutin 2.Fehuk mean 3.Fehuk mantega 4.Fehuk kanko mean	1.Since Indonesian times 2.Since the time of our ancestors 3.Since Indonesian times 4. Since the time of our ancestors	1.White 2.Red 3.Red 4.Red	1.White 2.White 3.White 4.White	1.White 2.White 3.White 4.White	1.Early harvest, good leaves 2.Tastes good, fragrant 3.Big tuber, tastes good when processed as bread/cake 4.Increases appetite and prevents disease	1. 3 months 2. 3 months 3. 4 months 4. 3-4 months	1. 4 months 2. 4 months 3. 5 months 4. 5 months
	Seloi kraik	1.Sekar meran (Mambae) 2.Sekar butin	1.Fehuk mean 2.Fehuk mutin	1&2. Since the time of our ancestors	1.Red 2.White	1.White 2.White	1.White 2.White	1&2. Sweet, taste, good reserve food	1&2. 5-6 months, but 7 months will produce a good tuber	1&2. Able to stay in the soil up to 12 months
	Manucasa	1.Uhlae meran (Mambae) 2.Uhlae butin	1.Fehuk mean 2.Fehuk mutin	1&2. Since the time of our ancestors	1.Red 2.White	1.White slightly yellow 2.White	1.Yellow 2.White	1&2. Since the time of our ancestor	1&2. 5 months	1. More than 5 months 2. Not more than 5 months
Baucau	Garuwai	1. Sia dai (Makassae) 2.Sia dai 3.Sia dai 4. Sia dai	1.Rai nain 2.Cip-1 3.Cip-6 4.Cip-7	1. Since the time of ancestor 2. 7 months 3. 7 months 4. 7 months	1.Red 2.Red 3.Red 4.Red	1.White 2.White 3.White 4.White	1. White slightly yellow 2.White slightly yellow 3.White slightly yellow 4.White slightly yellow	1. No new varieties previously 2 & 3 & 4. Good, large tuber	1. 6 months 2. 3 months 3. 3 months 4. 3 months	1. 10 months 2. 8 months 3. 8 months 4. 8 months
	Buroma	1.Sia amu imiri (Makassae) 2.Sia amu butir	1.Mean 2.Mutin	1&2. Since the time of our ancestors	1.Red 2.White	1.White 2.White	1.White 2.White	1&2. For household food consumption	1. 3 months 2. 3 months	1. 4 months 2. 4 months
	Loilubo	1.Ilidae isi me (Waimua) 2.Ilidae baduku 3.Ilidae kaidaba 4.CIP-6	1.Mean 2.Mutin 3.Kanko 4.CIP-6	1&2&3. Since the time of our ancestors 4. 6 Months	1.Red 2.White 3.White 4.SOL variety	1.White 2.White 3.White 4. SOL Variety	1.White 2.White 3.White 4.White		1&2&3. Approx. 6 months 4. 3 months	1&2&3. 9 months 4. 4 months
	Woelakama	Ili dai hie (Waimua)	Fehuk mean	Since the time of our ancestor	Red, white	White	White	Since the time of our ancestor	2-3 months	6 months

Table 53. Continued

District	Village	Name of variety (local language)	Name of variety (Tetun)	First planted	Colour of outer skin	Color of inner skin	Colour of flesh	Reasons for growing this variety	Duration planting until harvest	Duration can remain in soil before decomposition
Liquica	Daru Leten	1.Sekar selapa (Mambae) 2.Sekar mautema 3.Sekar butin 4.Sekar planu 5.Sekar manana 6.Sekar gemen 7.Sekar maukrusa	1.Fehuk mean 2.Fehuk kinur 3.Fehuk mutin 4.Fehuk korderoja 5.Fehuk mutin 6.Fehuk kinur 7.Fehuk atauro	1-5. Since the time of our ancestors 6. From abroad 7. Since the time of our ancestors	1.Red 2.Red 3.White 4.Red 5.Yellow 6. Pale red	1.White 2.White 3.White 4.White 5.Yellow 6.White	1.White 2.Yellow 3.White 4.Speckled 5.Yellow 6.White	1. Sweet, early harvest 2.Early harvest 3.For consumption during hungry season 4. Sweet, fragrant 5. For consumption during the haungry season 6. Sweet, fragrant 7. Leaves can be consumed as greens	1. 5 months 2. 5 months 3. 5 months 4. 5 months 5. 5 months 6. 5 months 7. 5 months	1. 6 months 2. 6 months 3. 1 year 4. 5 months 5. 1 year 6. 6 months 7. 6 months
	Gugleur	1.Sebar buti (Tokodede) 2.Sebar boku (Tokodede) 3.Sebar meo (Tokodede)	1.Fehuk mutin 2.Fehuk tahan bo'ot 3.Fehuk mean	1. Since the time of our ancestors 2. ± 2-5 years ago (1999-2004) 3. Since the time of our ancestors	1.White 2.Red 3.Red	1.White 2.White 3.White	1.Yellowish 2.Yellowish 3.White	1. Sweet, fragrant 2.Able to be processed as bread 3. Sweet, fragrant	1. 8 months 2. 8 months 3. 8 months	1. 1 year 2. 1 year 3. 1 year
	Maubaralisa	1. Sevar mau tema, kai mego, butin (Tokodede) 2. Sevar buti 3. Sevar mege	1. Fehuk lokal (fehuk mean ho mutin no kinur) 2. CIP-1 3. CIP-7	1. Since the time of our ancestors 2. 2006 3. 2006	1.Three types: a)red, b)red, c)white 2. White 3. White	1.a)White, b)White, c)White 2.White 3.White	1.a) White, b)White, c)White 2.White Yellow 3.	1. Sweet, dry 2&3. Sweet	1. 8 months 2&3. 6 mths	1. 10 months 2&3. 7 mths
	Dato	1.Sehar ke (Tokodede) 2.Sehar mau tema 3.Sehar buti ku	1.Fehuk kinur (tahan bo'ot) 2.Fehuk mean 3.Fehuk mutin	1.Since 2000 2&3. Since the time of our ancestors	1.Two types: a)White, b)Red 2. Red 3. White, slightly yellow	1.a)White, b)White 2. Slightly yellow 3. Slightly yellow	1.a)White, b)White 2. Yellow 3. Yellow	1.Leaves can be consumed as greens 2&3. Planted since the time of our ancestors, sweet-tasting.	1. Planted January, harvested April (3 months) 2 & 3..Planted February, harvested June (4 months)	1. 3 months 2&3. 4 months
Manufahi	Dotik	1. Fehuk manu tolun (Tetun Terik) 2.Fehuk mean 3.Fehuk metan 4.Fehuk mutin	1. Fehuk manu tolun 2.Fehuk mean 3.Fehuk metan 4.Fehuk mutin	1&2&3&4. Since the time of our ancestors	1.Yellow 2.Red 3.White 4.White	1.Yellow 2.White 3.White 4.White	1.Yellow 2.White 3.Blackish 4.White	1.Good sweet taste 2.Big tuber, high yielding 3.Sweet 4.Sweet	1. 2-3 months 2. 3-4 months 3. 3-4 months 4. 3-4 months	1. 4-5 months 2. 5 months 3. 5 months 4. 5 months
	Mahakidan	1.Fehuk lolar (Tetun Terik) 2.Uhi ring 3.Fehuk aisae	1.Fehuk midar 2.Fehuk ring 3.Fehuk kumbile	1&2&3. Since the time of ancestor	1.Red, yellow 2.Red, white 3.Red and white	1.White, slightly yellow 2.White, red 3.White, red	1.Yellow, white, and mixed-colored 2.White 3.White	1&2&3. Sweet	1&2&3. 5 months	1. 6-7 months 2. 3 years 3. 6-7 months
	Letefoho	1.Umlae mau tema (Mambae) 2.Umlae kanko 3.Umlae kau lel 4.Umlae kau lel 5.Umlae mau rafu	1.Fehuk kinur 2.Fehuk kanko 3.Fehuk laran mean 4.Fehuk metan 5.Fehuk rahun	1&2. Since the time of our ancestors 3. Since Indonesian times 4&5. Since the time of our ancestors	1.Red 2.Red 3.White 4.White 5.White	1.White, slightly yellow 2.White 3.White 4.White 5.White	1.Yellow 2.White 3.White 4.Black, speckled 5. Speckled	1. Good taste, high starch content 2. Leaves can be consumed as greens 3. Sweet 4. Sweet 5. Sweet, good to eat when drinking coffee	1&2&3&4&5. 3 months	1&2&3&4&5. Harvest in August, if more than 2 months after this will decompose

Farmers tend to categorise varieties that they claim to be local (grown “since the time of our ancestors”) according to the color of the flesh (Tetum: *isin*) rather than the skin (Tetum: *kulit*). The most common colors are: red, yellow, white and black flesh. Respondents planted several varieties of sweet potato, with most planting 3-4, and several planting 5-7 varieties.

Five out of 14 respondents who planted sweet potato, harvested a second crop, and in 3 out of the 5 locations (Woelakama, Loilubo and Letefoho), the same varieties were planted for both seasons. However, in Garuwai, the respondent planted CIP-1, CIP-6, CIP-7 in both seasons, but the local variety (mixed-colored ‘rai nain’) in the first season only. CIP varieties planted in Garuwai in the second season are ready to harvest between August and October, before the rainy season begins, whereas the local variety is ready to harvest during the rainy season which leaves the potato vulnerable to rot.

Each respondent was asked to explain the positive characteristics of the sweet potato varieties grown. In total, the 14 respondents grew a total of 45 types of sweet potato with many being the same variety. Characteristics mentioned were sweetness, large-sized tuber, grown for reserve food, fragrance, early-harvesting, leaves can be consumed as greens, tastes good as bread, and appetite stimulant.

- Sweet. Sweetness to taste was the most commonly mentioned characteristic for sweet potato. Almost 60% of respondents mentioned sweetness for 16 out of the total of 45 sweet potato types mentioned. Those types mentioned as sweet were: the red-skinned ‘fehuk mean’ (Sarin, Gugleur, Maubaralisa, Daru Leten, Dato); the white-skinned ‘fehuk mutin’ (Maubaralisa, Gugleur, Sarin, Dato, Dotik); the white-yellow skinned/white fleshed ‘fehuk kinur’ (Maubaralisa, Daru Leten) and yellow-skinned and fleshed ‘manutolun’ (Dotik); the white-skinned/blackish-fleshed ‘fehuk metan’ (Dotik), and red and white-skinned/white-fleshed ‘kumbile’ and ‘fehuk ring’ (Mahakidan), (CIP-1 and CIP-7 (Maubaralisa), and the dark red-skinned ‘korderoja’ (Daru Leten).
- Large-sized tuber. 30% of respondents mentioned the size of the tuber in 7 out of the total of 45 types of sweet potato mentioned. The varieties mentioned as growing large-sized tubers were: CIP-6 (Loilubo, Garuwai); CIP-6 and CIP-7 (Garuwai); and the local varieties red-skinned ‘fehuk mean’, white-skinned ‘fehuk mutin’, and white-skinned ‘kanko’ (Loilubo).
- Fragrant. 20% of respondents mentioned fragrance as a characteristics in 3 varieties grown: the red-skinned ‘fehuk mean’ (Gugleur, Sarin) and the white-skinned ‘fehuk mutin’ (Gugleur).
- Reserve food. 15% of respondents from Selo Kraik and Daru Leten respectively, mentioned 4 varieties as suitable reserve food. None of these varieties are dried, and all can remain in the ground without decomposition for as long as 12 months. Those varieties mentioned were: the white ‘fehuk mutin’ (Selo Kraik, Daru Leten), a yellow-skinned, yellow-fleshed variety known in the Mambae language as ‘sekar manana’ (Daru Leten), and the red-skinned ‘fehuk mean’ (Selo Kraik).
- Early-harvesting. Sweet potato takes on average 3-4 months between planting and the first digging, with the shortest period of 2-3 months recorded for the red-skinned ‘fehuk mean’ in Woelakama, and 8 months recorded for the white-fleshed ‘fehuk mutin’, red-skinned ‘fehuk mean’ and red-skinned/yellow-fleshed ‘fehuk tahan bo’ot’ in Gugleur and Maubaralisa. 15% of respondents mentioned early harvesting as a characteristic of 3 varieties: the white-skinned and fleshed ‘konko mutin’ harvesting in 3 months (Sarin); the red ‘fehuk mean’ and white fleshed ‘fehuk kinur’ harvesting in 5 months (Daru Leten). In response to review comments about the unexpectedly large number of short-season varieties, the duration between planting and harvest listed for varieties in Table 53 above would benefit from further study in the field.
- Leaves can be consumed as greens. Three respondents mentioned the leaves of 3 varieties as suitable for consumption as a leafy green vegetable: the yellow ‘Atauro’ (Daru Leten), the white-skinned/white fleshed ‘fehuk kinur’ (Dato) and the red-skinned/white-fleshed ‘fehuk kanko’ (Letefoho).
- Tastes good as bread. Two respondents mentioned 2 varieties as suitable for making bread: the red-skinned/white-fleshed ‘mantega’ (Sarin) and yellowish-fleshed ‘fehuk tahan bo’ot’ (Gugleur).

- Appetite stimulant. One respondent (Sarin) mentioned the red-skinned/white-fleshed ‘kanko’ as stimulating one’s appetite and preventing disease.

5. Peanut (Tetum: fore rai)

Groundnuts (*Arachis hypogaea* L) represent an important world crop for the productions of edible oils (fourth most important source of edible oils) and vegetable protein (third most important crop). The majority of production is grown by smallholder farmers under rainfed conditions and with few inputs. Groundnut production in Timor reflects these characteristics. There are no reliable area or production statistics of groundnut in Timor Leste and while it is not a major crop, it is probably more widely grown than available statistics suggest (Williams pers.comm). Groundnuts in Timor are grown in small quantities within food gardens and several harvests may be made over the main wet season depending on favourable climatic conditions. Nondescript cultivars with low yield potential are grown and often suffer from iron chlorosis and folier diseases [including rust, early and late leaf spot] (Nigam et al 2003). Peanuts represent a supplementary food for farmer households and often provide a source of rural incomes when sold in small quantities at local markets.

5.1 Planting times

Table 54. Peanuts: first season planting times by village

District	Sub-District	Village	Elevation	Time of first season planting	Time of first season harvest
Aileu	Aileu	Sarin	935m	November	March
	Aileu	Seloi kraik	1077m	November	February (small peanuts), March (large peanuts)
	Liquidoe	Manucasa	1363m	Decembe	February until March
Baucau	Baucau	Gariwai	680m	November	March
	Vemassee	Loilubo	770m	December until January	March
	Vemassee	Vemassee tasi	225m	December	March
Liquica	Liquica	Daru Leten	1241m	December	April
	Liquica	Dato	34m	December	March until April
	Maubara	Gugleur	78m	November until December	February until March
	Maubara	Maubaralisa	998m	November	April until May
Manufahi	Alas	Mahakidan	20m	December for new gardens. November for old gardens (if rain has already fallen)	February until March
	Same	Betano	2m	December	February
	Same	Letefoho	408m	End of October until November	End of December (small), January (large)

Table 55. Peanuts: second season planting times by village

District	Sub-district	Village	Elevation	Time of second season planting\	Time of second season harvest
Baucau	Vemassee	Vemassee tasi	225m	April	June until August
Manufahi	Alas	Mahakidan	20m	April until May	August
	Same	Letefoho	408m	April until May	end of July (small peanuts), August (large peanuts)

Peanuts are generally planted after maize, several weeks after the start of the wet season. In many places, large and small peanut varieties are planted to ensure harvest times several weeks apart. Of the 13 farmers interviewed who planted peanuts, three respondents in Baucau and Manufahi planted a second season. According to the variety table below (Table 65), the same varieties are planted in both seasons. However, the respondent in Mahakidan claimed that the large peanut SoL variety given the name '*fore giar bo'ot*' (literally, large peanut in Tetun Terik), was not suited to planting in the second season (April until May) as it became waterlogged and rotted in the second rainy season on the south coast.

Table 56. Peanuts: signs for planting

Distrito	Village	Elevation	Sign for planting peanuts
Aileu	Sarin	935m	Plant after rain has fallen for many days, and after planting maize
	Seloi kraik	1077m	Plant after rain has fallen for 2 days, and after planting maize
	Manucasa	1363m	Plant after rain has fallen and after the maize has begun to grow
Manufahi	Betano	2m	Plant after heavy rain has fallen for one full day , and after planting maize
	Lete foho	408m	Plant after rain has fallen for 2-3 days, and after planting maize
	Mahakidan	20m	Plant after rain has fallen for several days, saturating the ground, and after planting maize
	Dotik	20m	Plant after heavy rain has fallen for 1 week, and after planting maize
Liquica	Dato	34m	Plant after rain has fallen for 1-2 weeks and has saturated the soil, and after planting maize
	Daru leten	1241m	Plant after the maize has been planted and weeded, and after planting maize
	Maubara lisa	998m	Plant after the rain has fallen for 1-2 days and has saturated the ground, and after planting maize
	Gugleur (loes)	78m	Plant after the rain has fallen for 1-2 weeks, and after planting maize
Baucau	Vemase tasi	255m	Plant after the rain has fallen for 6 days and saturated the ground, and after planting maize
	Gariwai	680m	Plant after heavy rain has fallen for 1 day and there is thunder, and after planting maize
	Loilubo	770m	Plant after rain has fallen for many days and after maize has been planted, and after planting maize

All respondents plant peanuts after rain has saturated the soil, and either after maize has been planted, or at the same time that maize is planted. In Letefoho only, peanuts are planted before maize, and in Mahakidan either crop may be planted first.

5.2 Cultivation

Garden preparation for peanuts

There is a tendency for farmers to harvest peanuts only once before shifting to a new garden. The exceptions are Betano and Mahakidan (Manufahi district) where peanuts are planted for three years before the garden is fallowed, and in Vemase Tasi and Loilubo (Baucau district) where respondents claimed they did not fallow peanut gardens at all. Farmers who cultivate peanuts tend to fallow the garden for 2-3 years prior to planting peanuts in that garden again. Fallow periods for higher elevations (e.g., Manucasa and Letefoho) were 1-2 years compared with 4-5 years in the north coast lowland area of Dato.

Table 57. Peanuts: fallow times for gardens

Village	Elevation	Length of time peanuts planted before garden left to fallow	Length of time garden left to fallow before opened again for planting peanuts
Sarin	935m	1 year	2-3 years
Seloi kraik	1077m	Depends on the fertility of the soil	Depends on the fertility of the soil
Manucasa	1363m	1 year	1-2 years
Betano	2m	3 years	2-3 years
Lete foho	408m	Don't usually shift but depends on fertility of the soil	1-2 years
Mahakidan	20m	3 years	2-3 years
Dato	20m	Same as maize (1-2 years)	Same as maize (4-5 years)
Daru leten	1241m	1 year	2-3 years
Maubara lisa	998m	1 year	2-3 years
Gugleur	78m	Same as maize (3 years)	Same as maize (2-3 years)
Vemase tasi	255m	No fallowing	No fallowing
Gariwai	680m	1 year	2-3 years
Loilubo	770m	No fallowing	No fallowing

Seed selection and preparation

Peanuts are selected as seed for planting from the previous year's harvest. Shells are removed, and large, rounded, dry peanuts that have no weevil damage are selected. In most places, peanuts are planted directly into the soil without soaking, however in some places (e.g., Manucasa), peanuts are soaked in water for 24 hours until germination and then planted out. Farmers use iron or wooden digging sticks to make the hole for planting 1-2 seeds at a distance of 10-30 cm. Either the foot is used to cover the hole again with soil, or a broom made of palm leaves is used to sweep soil across the hole.

One seed only is planted in each hole in Manucasa, Dato, Maubaralisa and Daru Leten, while 2 seeds are planted by the majority of respondents, in Sarin, Seloi kraik, Letefoho, Mahakidan, Betano, Gugleur, Garuwai, Woelakama, and Loilubo. There is an apparent correlation between elevation and number of seeds planted with more seeds planted at higher elevations. Planting holes are always closed over with either the tapered end of a digging stick, a broom made from leaves, or with the hand or foot.

Table 58. Peanuts: planting distance

Village	Planting distance ⁹
Sarin	40cm
Seloi kraik	20-24cm
Manucasa	20-25cm
Betano	20cm-40cm
Lete foho	30cm
Mahakidan	30cm-40cm
Dotik	40cm
Dato	20-30cm
Daru leten	10cm
Maubara lisa	1. 20-30cm for local variety, and 40cm for new variety
Gugleur	50cm
Vemase tasi	10cm-15cm
Gariwai	30cm-50cm
Loilubo	20cm

⁹ Meter ruler used by interview as reference measurement for respondent.

Table 59. Peanuts: method for closing planting hole by village

Village	Method for closing planting hole
Sarin	Tapered end of digging stick or sweep with bunch of leaves
Seloi kraik	Tapered end of digging stick
Manucasa	Tapered end of digging stick
Betano	Foot
Lete foho	Use foot, or leave it open and rain will close the hole over
Mahakidan	Foot
Dotik	Foot or tapered end of digging stick
Dato	Broom made from palm frond spine (Tetum: ai sar kesak)
Daru leten	Hand
Maubara lisa	Hand or broom
Gugleur (loes)	Foot
Vemase tasi	Hand
Gariwai	Foot
Loilubo	Foot

Weeding

Farmers use iron digging sticks and sickle for digging out the roots of weeds, *enchada* or mattock for weeding, and small machetes for slashing weeds. Weeds are also pulled out by hand. In most places, respondents dig out the roots of weeds. In Gugleur the respondent slashes weeds without digging out the root. Weeds that had been dug or slashed are usually removed from the garden to avoid re-growth. In terms of the signal for weeding, in at least one area (Dato, Liquica), weeding was initiated when flowering began. Farmers weed peanuts between one and three times during cultivation. There is no correlation between elevation and the number of weeding activities. There is a tendency for the first weeding activity to involve more people than subsequent weeding activities.

Table 60. Peanuts: frequency of weeding by village

District	Village	Elevation	Total number of weeding activities	Number of people and duration of first weeding activity	Number of people and duration of second weeding activity	Number of people and duration of third weeding activity
Aileu	Sarin	935m	Once	4-5 people	n/a	n/a
	Seloi kraik	1077m	Once	5-6 people	n/a	n/a
	Manucasa	1363m	Once	4 people	n/a	n/a
Baucau	Garuwai	680m	Three times	5-6 people	2-3 people	2-3 people (depends on the amount of weed)
	Loilubo	770m	Once	4-5 people	n/a	n/a
	Vemasse Tasi	255m	Twice	Farmer only (1 person)	Farmer only	n/a
Liquica	Daru Leten	1241m	Three times	1-2 people	1-2 people	1-2 people
	Dato	34m	Once	4-5 people	n/a	n/a
	Gugleur	78m	Three times	4-5 people	1-2 people	2-3 people
	Maubaralisa	998m	Twice	1 person	1 person	n/a
Manufahi	Mahakidan	20m	Twice	5-10 people (if large garden)	2-3 people (farmer only)	n/a
	Betano	2m	Once	2 people (farmer only)	n/a	n/a
	Letefoho	408m	Twice	4-5 people	4-5 people	

Harvesting

Respondents used two main methods of harvesting:

- dig the peanut bush out and leave the crop to dry on the surface of the soil, when dry pick or harvest the peanuts from the bush (Maubaralisa, Loilubo)
- use one's hand to dig out the peanuts from the soft soil (Manucasa, Seloikraik)

The respondent in Letefoho mentioned that the most efficient method was for some household members to dig out the bushes while other members stripped the bushes of peanuts, storing them directly into a sack or basket. In most places, peanuts are spread out on palm mats (Tetum: *biti*) or nylon tarpaulins (Tetum: *lona*) in the sun for up to half a day, then shelled, and selected as seed for planting the following year.

Storing

Respondents stored peanuts using one of two methods:

- above the hearth in the kitchen (Manucasa, Seloikraik, Letefoho, Mahakidan, Maubaralisa, Dato, Daru Leten)
- stored in second-hand drums (Garuwai, Vemasse Tasi, Loilubo)

Some farmers stored peanuts differently based on whether they were for consumption, or stored as seed for planting the following year. For example, in Daru Leten, Dato and Seloikraik, respondents mentioned that they stored peanuts for consumption in a drum, and seed for planting in a bamboo container or sack placed above the hearth. However, all respondents store peanuts in their shell whether for seed or for consumption (the one exception was Daru Leten where peanuts stored for consumption were either shelled or stored in the shell, while peanuts stored as seed for planting were shelled).

Table 61. Peanuts: storage methods for seed kept for planting, and consumption, by village

District	Village	Storage method for peanut set aside as seed for planting next year	Storage method for peanuts for consumption
Aileu	Sarin	Store in a drum	Missing data
	Seloikraik	Store in a plastic jerry can or bamboo tube (Tetum: <i>audora</i>)	Above the hearth in the kitchen
	Manucasa	Store in a nylon bag (Tetum: <i>karon/saku</i>)	Above the hearth in the kitchen
Baucau	Garuwai	Store in second-hand drum	Stored in second-hand drum
	Loilubo	Place in nylon bag then store inside a second-hand drum or in a basket woven from palm leaf (Tetum: <i>hokan</i>)	Stored in second-hand drum
	Vemasse Tasi	Store in second-hand drum, or put into a bag and suspend the bag	Stored in second-hand drum
Liquica	Daru Leten	Store in bag	Above the hearth in the kitchen
	Dato	Store in bag	Above the hearth in the kitchen
	Gugleur	Store in bag woven from sago leaf or rattan (Tetum: <i>saboko</i>)	Missing data
	Maubaralisa	Put into a bag and smoke above the hearth in the kitchen	Above the hearth in the kitchen
Manufahi	Mahakidan	Store in a bag kept inside the house	In a bag inside the house
	Betano	Store in a bag or sack	Store in a woven bag (Tetum: <i>kaut</i>) or sack
	Letefoho	Store in a sack and hang in the kitchen	In a bag inside the house
	Dotik	Store in a bag in a high place near the kitchen hearth	Missing data

5.3 Religious rituals associated with peanut cultivation

Daru Lete (Liquica) and Letefoho (Manufahi) are the only locations where religious rituals were conducted for peanuts. In Daru Lete, one ritual only is conducted at the time of seed preparation, about one month after planting maize. One or two household members select peanuts as seed for planting, place the seed on the edge of the garden area, then pray to the custodian spirit of the land (Tetum: *rai nain*) and ancestors (Tetum: *matebian*) for protection against animal damage to the peanut crop. This ritual is known as ‘*dalep lolo la-bria no rai ubun*’ in the Mambae language, literally, speaking to the custodian spirit and ancestors (dalep=to say/speak, lolo=to give, la=to, bria=ancestors, rai ubun=landlord spirit). This ritual is led by a household head and 3-4 households may be invited, including neighbours.

In Letefoho, two rituals are undertaken. The first is known as ‘*Tian*’ in the Laklei language and is carried out prior to planting to help ensure that the seed will produce good yields. The second ritual gives thanks to the ancestors following harvest and is known as ‘*Klale odi telihu*’ in the Laklei language. Chickens or pigs comprise the object of sacrifice for both rituals.

While no religious rituals associated with peanut cultivation were documented for Aileu district, in Manucasa the respondent elaborated several *lulik* or sacred beliefs in relation to peanuts that influences weeding practice. Members of the household or mutual labour group involved in weeding peanuts are restricted from drinking or eating, and from bringing matches, children, or animals into the garden during the activity of weeding. If this restriction is not followed, people believe that a poor crop will result and the roots (‘pegs’) of the peanut bush will resemble matches.

5.4 Division of labour for peanut cultivation

Mixed household groups, and to a much lesser extent gender-restricted household groups, are the dominant labour formations for cultivating peanuts. Mutual labour exchange was used for weeding and planting peanuts in a few areas only.

Mixed household groups

Mixed household groups carry out the majority of labour-intensive activities associated with peanut cultivation including: harvesting (up to 100% including 1 respondent using *either* a mixed household or mutual labour group), weeding (up to 92% or 10 respondents including 2 using *either* a mixed household or mutual labour group), drying (77% or 10 out of 13 respondents), storing (69% or 9 out of 13 respondents), planting (38% or 5 out of 13 respondents), and seed preparation (30% or 4 out of 13 respondents). In some areas (Manucasa, Seloi Kraik, Daru Leten), there was no gender-restricted division of labour with most activities undertaken by mixed household groups.

Table 62. Peanuts: activities carried out by mixed household groups

Commodity	Number of farmers	Seed/runner preparation	Planting	Weeding	Harvesting	Drying	Storing
Peanuts	13	30%	38%	Up to 92%	Up to 100%	77%	69%

Gender-restricted household groups

What differentiates peanut production from the other staple foods is that among respondents, there were no male-only formations for any activities associated with cultivating peanuts. In contrast, in several locations (Letefoho, Mahakidan, Dato, Maubaralisa and to a lesser extent Gugleur and Woelakama) activities such as seed preparation, planting, drying, and storing are undertaken by women-only household groups, or women-only mutual labour groups. However, for all of these activities where there is insufficient female labour, men assist. In other words, there is no gender taboo generated by custom in relation to peanut cultivation.

Women-only household groups are used for seed preparation (71% of respondents), planting (42% of respondents), storage (35%) and drying (28%). Given that women are members of mixed groups also, it can be said that women are involved in every activity associated with the cultivation of peanuts. The implication for this is that women must be targeted in any extension work in the area of peanut production.

Table 63. Peanuts: activities carried out by women-only household groups

Commodity	Number of farmers	Preparing seed/runners	Planting	Drying	Storing
Peanuts	13	71%	42%	28%	35%

Mutual labour exchange

For peanuts, mutual labour exchange groups usually comprise members of the household, of the extended family, and neighbours whose gardens share boundaries or are nearby. Group members may or may not be those same members of the mutual labour exchange group which forms for maize cultivation. Planting and weeding are two of the most labour intensive activities in the cultivation of peanuts. Three respondents (21%) used mutual labour groups for planting, and one of these mutual labour groups was composed of women only. Up to 28% of respondents used mutual labour groups for weeding peanuts: two respondents used mutual labour groups for weeding, and an additional two respondents used *either* mutual labour groups or household groups for weeding depending on labour availability in relation to the size of the crop.

Table 64. Peanuts: activities carried out by mutual labour groups

Commodity	Number of farmers	Planting	Weeding
Peanuts	13	21%	Up to 28%

5.5 Peanut varieties

Table 65. Table showing peanut varieties, by village

District	Village	Name of variety (local language)	Name of variety (Tetun or other)	Length of time planted	Color of seed	Size of peanut	Reasons for growing this variety	Duration planting until harvest
Aileu	Sarin	Missing data	1.PT 5 2.GN 11	1&2. Since 2005	1.Red 2.Red	1. Rounded (Tetum:bokar) 2. Narrow (Tetum: lotuk)	1. Willing to try 2. Early harvest	1.4-5 months 2. 3.5 months
	Seloi kraik	1. Hoer sua tun (Mambae) 2. Hoer sua loban	1.Fore rai bo'ot 2. Fore rai ki'ik	1&2. Since the time of our ancestors	1. Red 2. Slightly red	1. Large 2. Small	1. Round seed 2. Early harvest	1. 4 months 2. 3 months
	Manucasa	1. Hoer sua tun (Mambae) 2. Hoer sua loban	1. Fore rai bo'ot 2. Fore rai ki'ik	1&2. Since the time of our ancestors	1. Slightly red 2. Slightly red	1. Large 2. Small	1. Can eat while drinking tea or coffee, and serve as a snack for guests, and can also sell it 2. Higher yielding than #1, one plant produces many nuts	1. 4 months 2. 3 months
Baucau	Gariwai	1.Uta o abere (Makasae) 2.Uta mata	1.PT5 2.Local	1. Since 2002 2. Since the time of our ancestors	1.Red 2.Red	1. Large 2. Small	1.Brings good price 2.For household consumption	1. 5 months 2. 3 months
	Loilubo	1.Uta oli (Waimua) 2. Uta ana	Fore rai hibrida	Since the time of our ancestors	1. Red 2. Red	1. Large 2. Small	Brings good price, sweet tasting	3 months
	Woelakama	1. Uta haso (Waimua) 2. Uto oli 3. Uto komo 4. Uto oli	1. Fore rai lotuk nani 2. Fore rai bo'ot nani 3. Fore rai lotuk 4. Fore rai bo'ot	1&2&3&4. Since the time of our ancestors	1.Red 2.Coffee-colored 3.Red 4. Red	1. Narrow 2. Large 3. Rounded 4. Large	1&2&3&4. Since the time of our ancestors, therefore these varieties must not be lost	1. 3 months 2. 4 months 3. 3 months 4. 4 months
Liquica	Daru Leten	1.Hurisa makau (Mambae) 2.Hurisa bibrae 3.Hurisa kruma	1.Fore rai bo'ot 2.Fore rai musan tolu 3.Fore rai ki'ik	1.From Aileu 2.Since Indonesian times 3.From Maliana	1.Slightly yellow 2. Slightly yellow 3. Red and white	1. Large 2. Medium 3. Small	1.Grows well and can use as medicine for the skin disease <i>sarampu</i> 2.High yielding 3.High yielding, sweet tasting	1&2&3. 4 months
	Dato	1.Hurisi makau (Tokodede) 2. Hurisi bruma	1.Fore rai bo'ot (musan bo'ot) 2. Fore rai ki'ik (musan lotuk) fore rai lais	1&2. Since the time of our ancestors	1. Red 2. Red	1. Large 2. Small	1. Weighs heavily 2. Early harvest	1. 3 months 2. 2.5 months
	Gugleur	Urissi buti (Tokodede)	Isin mutin	Since the time of our ancestors	White	Large	It is our custom to plant this variety every year, and it is sweet	3 months
	Maubaralisa	1.Hurisi (Tokodede) 2.Hurisi kaidiruu 3.Hurisi buti	1.Fore rai local 2.Fore rai mean 3.Fore rai mutin	1&2&3. Since the time of our ancestors	1. Red 2. Red 3. White	1. Large 2. Small 3. Small	1.Consume as snack food, sweet tasting 2.Use as medicine (rub skinned peanut onto skin) for <i>sarampu</i> (Tetum: measles) 3.Snack food, able to be sold	1&2&3. 3 months
Manufahi	Mahakidan	1.missing data 2. Fore giar bo'ot	1.Fore rai lotuk 2.Fore rai bo'ot (SOL)	1. Since the time of our ancestors 2. Since October 2005	1. Red, some white-ish 2.Red	1. Narrow 2. Rounded	1. High yielding, sweet tasting 2. Large nut	1. 3.5 months 2. 3 months
	Betano	1. Hoer mlae buti tua (Mambae) 2. Hoer mlae buti loban	1.Fore rai mutin bo'ot 2. Fore rai mutin ki'ik	1&2. Since the time of our ancestors	1.Red, white 2.Red, white	1.Large 2.Small	1. Sweeter 2. Sweet	1. 3 months 2. 3 months
	Letefoho	1. Kurlaku lobok (Laklei) 2. Kurlaku bosuk	1.Fore rai ki'ik 2. Fore rai bo'ot	1&2. Since the time of our ancestors	1.Red 2.Slightly red	1. Small nut, one shell contains two nuts 2. Large nut, one shell contains 3-4 nuts	1. Tastes better than beans [pulse, not long bean] and fries well and can sell 2. Produces many nuts	1. 2.5 months 2. 3 months

Farmers categorise peanut varieties according to size (large or small), or kernel color (white or red). Generally, small nuts are grown mainly for household consumption and are considered to be sweeter-tasting than the larger nut which is grown mainly for sale. All but one respondent grew at least one large and small variety with some (e.g., Woelakama) growing two of each. The size of the nut affects harvesting time with large nuts harvested in 3-5 months depending on the variety, and smaller nuts harvested in 2.5 to 3.5 months. It is likely that the SoL variety PT5 (Utumaua) has seed dormancy, meaning that there is a duration of 2-3 months between harvest and planting.

Four respondents grew new varieties: the variety referred to as 'fore rai musan tolu' (three kernels per single shell) and reportedly from Indonesia (Daru Leten), PT5 (Garuwai), PT5 and GN11 introduced by SoL (Sarin), and the SoL variety known as 'Fore giar bo'ot' (Mahakidan).

Three out of 13 respondents harvested a second peanut crop annually. Peanuts were grown during the second rainy season on the south coast (Letefoho, Mahakidan), and at Vemasse Tasi (Baucau). The same varieties are planted in both seasons, however, the large SoL variety referred to locally as 'fore giar bo'ot' in Mahakidan was said to be unsuitable for planting in the second season (April until May) as it is considered that waterlogging causes it to rot.

Each respondent was asked to explain the positive characteristics of the peanut varieties grown. In total, the 13 respondents grew a total of 28 types of peanut with many likely being the same variety. Characteristics mentioned were: saleability, yield, sweet-tasting, early harvesting, snack food, large-sized nut, and medicine for the skin disease *sarampu*.

- Saleability. 5 out of 13 respondents mentioned that they sold 5 varieties, both large and small nut varieties: the large, red nut 'fore rai bo'ot' (Manucasa), PT5 (Garuwai), the red nut described as hibrid 'fore rai hibrida' (Loilubo), the white nut 'fore rai mutin' (Maubaralisa), and the small, red 'fore rai ki'ik' which contains two nuts in a single shell (Letefoho).
- Yield. 5 out of 13 respondents mentioned yield as a characteristic of the following 5 varieties that included large and small nut varieties: the small, red nut 'fore rai ki'ik' (Manucasa), the slightly yellow nut variety known as 'fore rai musan tolu' containing 3 nuts in each shell (Daru Leten), the small red sometimes white-ish nut 'fore rai ki'ik' (Daru Leten, Mahakidan), and the large red nut 'fore rai bo'ot' which yields 3-4 nuts in each shell (Letefoho).
- Sweet-tasting. 5 out of 13 respondents mentioned sweetness as a characteristic of 6 varieties that included large and small nut varieties: the narrow, red sometimes white-ish nut 'fore rai lotuk' (Mahakidan), the large red or white nut 'fore rai mutin bo'ot' (Betano), the small red or white nut 'fore rai mutin ki'ik' (Betano), the large red nut 'fore rai lokal' (Maubaralisa), the small red or white 'fore rai ki'ik' (Daru Leten), and the variety referred to as hibrid 'fore rai hibrida' (Loilubo).
- Early harvesting. 3 out of 13 respondents mentioned early harvesting as a characteristic of 3 varieties, all of them small: GN11 which harvests in 3.5 months (Sarin), and small red nut 'fore rai ki'ik' which harvests in 3 months in Selo Kraik and 2.5 months in Dato.
- Snack food. 2 out of 13 respondents mentioned 3 varieties that can be consumed as a snack food: the large reddish nut 'fore rai bo'ot' (Manucasa), the large red nut 'fore rai lokal' and small white nut 'fore rai mutin' varieties (Maubaralisa).
- Large-sized nut. 2 out of 13 respondents mentioned large-sized nut as a characteristic of 2 varieties, both of them large: red nut 'fore rai bo'ot' in Dato and Mahakidan.

- Medicinal. 2 out of 13 respondents mentioned the large slightly yellow 'fore rai bo'ot' (Daru Leten) and small red nut 'fore rai mean' (Maubaralisa) used as medicine to treat the skin disease *sarampu*.

6. Cassava (Tetum: ai farinha)

Cassava (*Manihot esculenta Crantz*) is the third most important food crop grown in Timor after maize and rice, both in terms of area and production. It was popularized as a food crop during the second world war under the Japanese occupation (Fox 2003: 108), and was a favoured crop during the Indonesian period. In 1997 the area planted to cassava was reportedly greater than that allocated to irrigated rice (Narve 1999:18). Cassava is used mainly for direct household consumption as well as supplementary feeding for domestic livestock, especially pigs. Most of the local varieties are 'sweet' with low concentrations of cyanide in the tuber. The main limited factor in cassava production in Timor is the low yields (4t / ha) and starch contents (Howeler et. al. 2003).

Cassava as a species is particularly well adapted to dry climates and can tolerate long periods of drought (six-eight months). It grows well in acid soils but less so in areas of high pH, conditions found widely across Timor. Cassava is commonly cultivated in house gardens across Timor where it is stored in the ground and pulled up when needed, peeled and boiled with little or no prior processing. Cassava is often eaten as a snack or supplementary food. The leaves are commonly boiled and eaten as a green vegetable.

There is little or no processing of cassava into starch, chips or other industrial processing in Timor Leste at present, but there is considerable potential for cassava to be developed along these lines, providing opportunities for small scale enterprises and commercial marketing.

6.1 Planting times

Table 66. Cassava: first season planting times by village

District	Sub-district	Village	Elevation	First season planting	First season harvest
Aileu	Aileu	Lausi	906m	November	June to July
	Aileu	Seloi kraik	1077m	October to November	January to March
	Liquidoe	Manucasa	1363m	November	August to October
Baucau	Baucau	Garuwai	680m	November	August to September
	Vemassee	Loilubo	770m	November	August
	Vemassee	Vemassee tasi	225m	December	July
Liquica	Liquica	Daru Leten	1241m	November	January (15 months duration between planting and harvest)
	Liquica	Dato	34m	November	August
	Maubara	Gugleur	78m	November	March
	Maubara	Maubaralisa	998m	End of October until November	July until August
Manufahi	Alas	Dotik	20m	November until December	April-June for immediate consumption, August for drying
	Alas	Mahakidan	20m	December	August
	Same	Letefoho	408m	November until December	November (minimum 10 month duration between planting and harvest)

Table 67. Cassava: second season planting times by village

District	Sub-district	Village	Elevation	Second season planting	Second season harvest
Baucau	Vemasse	Vemasse tasi	225m	July	November to December (± 5 months duration planting to harvest)
	Baucau	Buroma	2m	June	November to December
Liquica	Maubara	Gugleur	78m	April	August to September (± 5 months)
Manufahi	Alas	Mahakidan	20m	April to May	April (± 1 year)
	Same	Letefoho	408m	April to May	April (± 1 year)

Table 68. Cassava: signs for planting by village

Distrito	Suco	Elevation	Sign for planting cassava
Aileu	Seloi kraik	1077m	Plant 1 week before rain has fallen
	Lausi	906m	Plant 1-2 days after heavy rain has fallen
	Manucasa	1363m	Plant 1 week after rain has fallen, and after maize has been planted
Manufahi	Lete foho	408m	Plant after rain has fallen for many days and after maize has been planted
	Mahakidan	20m	Plant after heavy rain has fallen for 3 days and after maize has been planted
	Dotik	20m	Plant after heavy rain has fallen for 1 week
Liquica	Dato	34m	Plant after rain has fallen for 1-2 days and soil is saturated, and after maize has been planted
	Daru leten	1241m	Plant after rain has fallen and after maize has been planted
	Maubara lisa	998m	Plant after rain has fallen for many days and the ground is saturated
	Gugleur	78m	Plant after rain has fallen for 1-2 weeks
Baucau	Vemase tasi	255m	Plant after rain has fallen for many days and after maize has been planted
	Gariwai	680m	Plant after heavy rain has fallen for 1 day and there is thunder
	Loilubo	770m	Plant after rain has fallen and maize has been planted

For first season planting, all respondents waited until the early rain had soaked the ground, and after maize has been planted. For the five farmers who planted maize in the dry season, one only (Buroma) watered by hand.

6.2 Planting

Selecting cassava stems for planting

Generally cassava stems are selected based on the following characteristics: large stems that are neither too young/soft nor too woody with leaf nodes close together. Many respondents selected stems with many leaf nodes spaced close together (Seloi kraik, Lausi, Letefoho, Mahakidan, Daru leten, Gugleur, Dato, Woelakama, Loilubo), while others selected stems that were large in size (Liquidoe, Dato, Woelakama, Buroma). In Gugleur and Maubaralisa, respondents selected stems that were large, green, young, and contained much sap (Tetum: *be'en*).

Some farmers cut stems based on the number of leaf nodes. Quantity of nodes differed from place to place. For example, 8 in Seloi kraik, 3 in Dotik and Daru leten, and 5-6 in Gariwai and Loilubo. In other places, farmers cut stems based on measurement: 15-20cm (Letefoho, Maubara lisa, Gugleur, Buroma), 30-40cm (Maubaralisa), 20cm (Buroma).

Planting cassava for tuber production

Most respondents calculated planting distance between cassava stems. Planting distance differed from place to place: 50 cm (Dato, Daru leten), 70-80cm (Selo kraik), and 1 m (Liquidoe, Letefoho).

Table 69. Cassava: planting distances

Village	Planting distance for cassava ¹⁰
Selo kraik	80cm-1m
Lausi	1m-1.35m
Manucasa	78cm-1m
Lete foho	80cm-1m
Mahakidan	1m
Dotik	1.5m
Dato	85cm-1m
Daru leten	40cm
Maubara lisa	1m-1.20m
Gugleur	1m
Vemase tasi	1m
Gariwai	1m
Loilubo	1.50m-2m
Buroma	50cm

All respondents planted cassava arbitrarily (i.e., random) except the respondent from Gugleur who planted cassava in lines. The number of cassava stems planted in a single hole differed according to place: 1 stem (Selo kraik, Dotik, Dato, Buroma), 1-2 stems (Liquidoe, Lausi), 2 stems (Letefoho, Mahakidan, Daru leten, Woelakama, Loilubo) and 3 stems (Gugleur). The number of leaf nodes planted below and above the surface also differed according to place. For example, the Gugleur respondent planted stems so that 4-5 nodes were beneath the surface and another 4-5 nodes were left above the soil's surface. In contrast, the Dato respondent (same elevation, same district) planted stems with 2 nodes below the soil and 3 above. Half of respondents closed the planting hole, that is, pressed the soil around the cassava stem using the tapered end of the digging stick, hand or foot. The other half left the planting hole open, relying on rain to close over the hole with soil. Whether respondents close the hole or not appears quite arbitrary: there is no correlation between elevation and method, and the only correlation between district and method is among respondents from Baucau who uniformly use the hand to cover over the hole.

Table 70. Cassava: method of closing planting hole

Village	Method for closing planting hole
Selo kraik	Tapered end of digging stick
Lausi	Hole left open, rain will cause it to close
Manucasa	Foot
Betano	Hand
Lete foho	Hand, or can leave open and rain will cause it to close over
Mahakidan	Hand, or can leave open and rain will cause it to close over
Dotik	No need to close over
Dato	Not closed
Daru leten	Use hand or foot
Maubara lisa	Leave open, rain will close the hole
Gugleur (loes)	Leave open, rain will close the hole
Vemase tasi	Hand
Gariwai	Hand

¹⁰ Meter ruler used as reference

Loilubo	Hand
Buroma	Hand

Planting cassava for leaf production

The respondent in Selo kraik explained that while local people do not eat the leaves of bitter cassava during the wet season, they may be eaten if they are boiled and the water discarded 2-3 times before eating, otherwise toxicity (Tetum: *lanu*) may occur. Some mentioned that the leaves should not be harvested until the cassava tuber had developed, others mentioned that the leaves should be thick and healthy (Tetum: *buras*). No specific planting method such as planting vertically or horizontally was mentioned by respondents, although anecdotal evidence suggests some farmers lie cassava stalks horizontally when planted for leaf production (pers. comm. Rob Williams). Some claimed that any cassava variety was suitable for harvesting leaves for eating, while others mentioned the following varieties as producing good leaves for eating:

- Buraisa, a non-cultivated variety (Lausi, Vemase tasi)
- Any variety except bitter (Selo kraik)
- White cassava (Daru Leten, Letefoho)
- Any cultivated cassava (Maubaralisa)
- Cassava with fine leaves as these are sweeter (Gugleur, Mahakidan)
- Mentega cassava (Mahakidan, Letefoho)
- Sabaun cassava (Letefoho)

Weeding

Weeds are removed from cassava crops using several methods: slashing with machete, digging the roots out using a crowbar or hoe, and pulling out by hand. In many locations (Liquidoe, Letefoho, Dotik, Maubara lisa, Gugleur, Daru leten, Woelakama), harvested weeds are heaped at the base of the cassava plant to decompose and become humus.

Harvest

Generally, when the surface soil splits or breaks open, this is a sign that the cassava is ready to be harvested. Respondents in Daru leten and Dotik claimed that cassava was ready to harvest when the seeds (Tetum: *fuau*) of the cassava foliage were mature. Cassava is harvested for daily consumption, sale, as well as for drying as food reserves for the hungry period (usually December until the new maize harvest in February). Farmers use a crowbar or the 'ear' of a digging stick (Tetum: *tilun*) for severing the tuber from the cassava root. In many places, some cassava roots are left in the garden to reproduce.

There is probably a correlation between fencing and harvesting cassava. Untethered pigs will root out cassava left in an open garden, whereas cassava can remain in the ground undisturbed in a fenced garden. Among respondents, all farmers fenced cassava gardens. The exception were those areas where farmers routinely tether animals (cows, goats, pigs, chickens), and there is no need to construct fences. In some areas (e.g., Daru lete) it is the role of the village head (Tetum: *xefe suco*) to regulate tethering, whereas in other areas (e.g., Gugleur) there is no regulation and untethered animals mean that farmers must fence all garden areas. In some areas, animals must be tethered and where the tether comes loose, or breaks, and the animal damages another farmer's garden, there is a pre-determined response (e.g., Selo kraik). The first breach results in the animal's owner being informed, the second breach can result in a fine, and the third breach can result in the animal being killed.

Drying cassava

Table 71. Cassava: harvesting for consumption and drying

Village	Elevation	Month in which cassava starts to be harvested for daily consumption	Month in which cassava is completely harvested	Month in which cassava is dug for drying (as a food reserve)
Lausi	906m	May to June	August to September	August to September
Seloi kraik	1077m	June to July	August to September	August to September
Manucasa	1363m	June to July	August to September	September (depends on yield, if low yield no drying)
Buroma	7m	November to December	January to February	No drying done
Garuwai	680m	June to July	Some cassava always left in the garden	No drying done
Loilubo	770m	July	September to October	August
Welakama	255m	June to July	Some cassava always left in the garden	August to September
Daru Leten	1241m	June to July	Some cassava always left in the garden	August to September
Dato	34m	June to July	Some cassava always left in the garden so that it can reproduce	July to August
Gugleur	78m	June to July	August to September	August to September
Maubaralisa	998m	January to February	August to September	August to September
Dotik	20m	July	Depends on the condition of the garden, can remain in the ground for 2-3 years	August to September
Mahakidan	20m	July	August	August to September
Letefoho	408m	August	Some cassava always left in the garden so that it can reproduce	August to September

In 85 per cent of places, cassava is dried as a reserve food. Among this study's respondents, the exception was two lowland areas in Baucau (Buroma and Garuwai). To make dried cassava ready for use it is re-hydrated by soaking in water for several days until soft, dried out a little, and then boiled for consumption. Cassava is dug for drying some 4-5 months after farmers begin digging it for daily consumption needs.

To dry, the cassava skin is removed and then the tuber is cut into small pieces. In Aileu, and in some locations in Manufahi and Liquica, cassava is placed to dry on an elevated shelf (Tetum: *hadak leten*) in the kitchen near the hearth. In Liquica (Maubaralisa and Gugleur), cassava may be dried on the rooftop, or on a nylon tarpaulin or reed mat on the ground close to the main house. In Dato (Liquica), cassava is hung in a nylon sack from a tree in the sun.

Storing

Dried cassava may be stored using several methods:

- above the hearth in the kitchen: Aileu district (Seloi kraik, Manucasa), Manufahi district (Dotik), Liquica district (Gugleur)
- in a sack placed in a second hand drum: Aileu district (Lausi)
- on an elevated and roofed platform near the main house: Liquica district (Maubaralisa)
- an elevated platform located in the main house: Liquica district (Daru leten)
- in a woven sack made from reed hung inside the house: Baucau district (Loilubo)

6.3 Division of labour for cultivation of cassava

Mixed household groups were the dominant labour formation for cultivating cassava, followed by gender-restricted household groups. Mutual labour exchange groups were used in some places, mainly for weeding.

Mixed household group

Respondents used mixed household groups for the majority of activities associated with the cultivation of cassava, mirroring the pattern for the other tuber sweet potato. For example, harvesting (71% or 10 out of 14 respondents), drying (66% or 6 out of 9 respondents), preparation of runners (64% or 9 out of 14 respondents), planting (78% or 11 out of 14 respondents including 3 respondents using *either* a mixed household group or mutual labour group), and storing (55% or 5 out of 9 respondents).

Table 72. Cassava: activities carried out by mixed household groups

Commodity	Number of farmers	Seed/runner preparation	Planting	Harvesting	Drying	Storing
Cassava	14	64%	Up to 78%	71%	66%	55%

In several locations, activities undertaken by household groups were gender restricted, however for all activities men assisted women-only household groups where labour was insufficient. The activity most likely to be undertaken by women-only household groups was storing cassava (44% or 4 out of 9 respondents), followed by harvesting (21% or 3 out of 14 respondents), drying (22% or 2 out of 9 respondents), and stem preparation and planting (each 1 respondent). Given that women are members of mixed household groups also, it can be said that women are involved in most activities associated with the cultivation of cassava. The implication for this is that women must be targeted in any extension work in the area of cassava production, particularly post-harvest processing and storage.

Table 73. Cassava: activities carried out by women-only household groups

Commodity	Number of farmers	Preparing stems	Planting	Harvesting	Drying	Storing
Cassava	14	7%	7%	21%	22%	44%

The activity most likely to be carried out by men-only household groups is stem preparation (21% or 3 out of 14 respondents) and weeding (14% or 2 out of 14 respondents).

Mutual labour exchange

Compared to maize and rice, mutual labour groups were used much less in the cultivation cycle of cassava, once again following the pattern for the other tuber sweet potato. While mutual labour exchange groups were most likely to be used for the activities of weeding and planting, the majority of respondents used household groups to carry out both of these activities. In Manucasa and Gugleur, weeding cassava was undertaken by mutual labour groups, and in Seloikraik, Daru Leten, Maubaralisa and Dotik weeding was done *either* by mutual labour group or household depending on the labour availability in relation to garden size. Combining these two categories, it can be said that up to 42% (six out of 14 respondents) used mutual labour groups to weed cassava. Additionally, 28% of respondents used *either* mutual labour groups or household groups to plant cassava in Seloikraik, Daru Leten, Dotik and Letefoho, and one respondent (Seloikraik) also used *either* a mutual labour group or household group to prepare cassava runners.

Table 74. Cassava: activities carried out by mutual labour groups

Commodity	Number of farmers	Planting	Weeding
Cassava	14	Up to 28%	Up to 42%

6.4 Cassava varieties

Table 75. Table of cassava varieties, by village

District	Village	Variety in Tetun Language	Name of variety in Local Language	Length of time planted	Color of outer skin	Color of inner skin	Color of flesh	Bitter or sweet	Reasons for growing this variety	Duration planting until harvest	Length of time in the soil before decomposes
Aileu	Lausi	1.Mantega 2.Maukafir 3.Nona metan	1.Badiku mantega (Mambae) 2.Badiku maukafir 3.Badiku nona metan	1&2&3. Since the time of ancestor	1. Coffee-colored 2. Coffee-colored 3. Coffee-colored	1. White 2. Red 3. White	1. Yellow 2. White 3. White	1. Very sweet 2. Sweet 3. Sweet	1.Fragrant 2.Fragrant 3. Food reserve for hungry season	1. 6-7 months 2. 6-7 months 3. 6 months	1. 2.5 years 2. 2.5 years 3. 2-3 years
	Seloi kraik	1.Mina morin 2.Nona metan 3.Bazartete 4.Mantega 5.Moruk	1.Saem silva (Mambae) 2.Saem nona metan 3.Saem bazartete 4.Saem maun telo 5.Saem klesun metan	1&2&3. Since the time of ancestor 4&5. Since the Indonesian period	1.Black 2.Black 3.Black 4.Black 5.Black	1.Red 2.White 3.White 4.White 5.Coffee-colored	1.White 2.White 3.White 4.White 5.White	1.Sweet 2.Sweet 3.Sweet 4.Sweet 5.Bitter	1&3.Soft, fragrant, early harvest and cooks quickly 2.Roots continue growing after harvest 4.Good for making cakes/bread for special occasions 5.Food reserve for hungry season	1&2&3&4. 1-2 years 5. 2 years	1. 3 years 2. 3.5-4 years 3. 3.5-4 years 4. 1.5 years 5. Long duration
	Manucasa	1.Mau kafir 2.Mantega 3.Mantega	1.Badiku mau kafir (Mambae) 2.Badiku mantega 3.Badiku ai lela	1&2&3. Since the time of our ancestors	1. Black 2. Black 3. Black	1. Red 2. White, slightly yellow 3. White	1. White 2. Yellow 3. White	1. Sweet 2. Sweet 3. Sweet	1.Soft when boiled, sweet 2. Fragrant, never tire of eating, yellow color 3. Weevil resistant	1. 2-3 years 2. 2 years 3. 2-3 years	1&2&3. 1 year
Baucau	Buroma	1. Mantega 2. Mutin 3. Kulu	1.Ate sia mantega (Makassae) 2. Ate siaambutiri 3. Kulu ate sia	1&2. Since the time of our ancestors 3. _____	1.Black 2.Black 3.Black	1.White, slightly yellow 2.White 3.White	1.Yellow 2.White 3.White	1.Sweet 2.Sweet 3.Sweet	1&2. Augments household food 3.missing data	1&2. 5 months 3.missing data	1&2. 1 year 3.missing data
	Gariwai	1. Mantega 2.Kulit mean 3.Kulit mutin	1. Ate sia mantega (Makassae) 2. Ate sia builara 3. Ate sia kulu	1&2&3. Since ±1980	1. Black 2. Black 3. Black	1.White, slightly yellow 2. Red 3. White	1.Yellow 2. White 3. White	1. Sweet 2. Sweet 3. Sweet	1&2&3. Quality tuber, sweet, high starch content	1&2&3. 9-10 months	1&2&3. Approximately 2 years
	Loilubo	1.Mantega 2.Lisboa 3.Buraisa 4.Manunho	1.Ilidai kai mantega (Waimua) 2. Iildaiki lisboa 3. Iildaikai boaraisa 4. Iildaikai manunho	1&2&3&4. Since the time of our ancestors	1. Black 2. Black 3. Black 4. Black	1. Yellow 2. White 3. White 4. White	1.Yellow 2. White 3. White 4. White	1. Sweet 2. Sweet 3. Bitter 4. Sweet	1.Sweet, fragrant 2.Soft 3.Food reserve for hungry season 4.Soft, fragrant	1&2&3&4. 1year	1&2&3&4. ± 3 years

Table 75. Continued

District	Village	Variety in Tetun Language	Name of variety in Local Language	Length of time planted	Color of outer skin	Color of inner skin	Color of flesh	Bitter or sweet	Reasons for growing this variety	Duration planting until harvest	Length of time in the soil before decomposes
	Woelakama	1.Mantega 2.Buraisa 3.Mutin	1.Dekai mantega (Waimua) 2.Dekai buraisa 3. Kai buta	1. Since Indonesian period 2&3. Since the time of our ancestors	1. Black 2. Black 3. Black	1. Slightly yellow 2.White 3. Red and white	1. Yellow 2. White 3. White	1. Sweet 2. Sweet 3. Sweet	1&2&3. Sweet	1&2&3. 6 months	1&2&3. 8 months
Liquica	Daru Leten	1. Metan 2.Mutin 3. Nona metan	1. Saem ai metan (Mambae) 2. Saem ai buti 3. Saem ai nona metan	1&2&3. Since the time of our ancestors					1. High yielding, one plant can produce 10 tubers 2. Weevil resistant 3. High starch content, tasty	1. 1year 2. 2 years 3. 1 year	1. More than 1 year 2. Until 2 years then decomposes 3. More than 1 year
	Dato	1.Mentega 2.Nona metan 3.Mina morin 4. Kangko	1.Kaisame mantega (Tokodede) 2. Sangkai ai 3. Sangkai mina morin 4. Sangkai klesu	1&2&3&4. Since the time of our ancestors	1. Black 2. missing data 3.missing data 4.missing data	1. Yellow 2. missing data 3.missing data 4. missing data	1. Yellow 2. White 3.missing data 4.missing data	1. Sweet 2. missing data 3.missing data 4.missing data	1. Fragrant 2&3&4. Sweet	1&2&3&4. ±6 months	1&2&3&4. 3-4 years
	Gugleur	1. Mantega 2. Nona metan 3. Mutin, mean 4. Buraisa	1. Kaisame mantega (Tokodede) 2. Kaisame nona metan 3. Kaisame rua bruma 4. Kaisame buraisa	1&2&3&4. Since the time of our ancestors	1. Black, coffee-colored 2. Black 3. missing data 4.missing data	1. Yellow 2. Red 3.missing data 4.missing data	1. Yellow 2. White 3.missing data 4.missing data	1. Sweet 2. Sweet 3.missing data 4.missing data	1. Fragrant 2. For animal food 3. Consume leaves as leafy green 4. Stem used for fencing, food reserve for hungry season	1. 3.5 months 2. 3.5 months 3. 4 months 4. 1 year	1&2. 4-5 months 3. 6 months 4. 2 years
	Maubaralisa	1. Mantega 2. Tolan toka 3. Ulun moruk 4. Birapo 5. Mutin 6. Fuik	1. Kaisame mantega (Tokodede) 2. Kaisame nona metan 3. Kaisame ui 4. Kaisame ui 5. Kaisame but 6. kaisame ui keimeta	1&2&3&4&5&6. Since the time of our ancestors	1.Black 2.Black 3. Black 4. Black 5. missing data 6. missing data	1. White 2. White 3. White 4. White 5. missing data 6. missing data	1. Yellow 2. White 3. White 4. White 5. missing data 6. missing data	1. Sweet 2. Sweet 3. Dry season: bitter, wet season: sweet 4. Dry season: bitter, wet season: sweet 5. missing data	1.Early harvest 2. Early harvest 3&4. Food reserve for hungry season 5. Can store for 3-4 years 6. Food reserve for hungry season	1. 10 months 2. 10 months 3. 1 year 4. 1 year 5. 1 year 6. 1 year	1. 1.5 years 2. 1.5 years 3. 2 years 4. 2 years 5. 3-4 years 6. 3.5 years
Manufahi	Dotik	1. Modok 2. Mean 3. Mutin	1. Mantolon (Tetun Terik) 2. Mean 3. Mutin	1&2&3. Since the time of our ancestors	1.Black 2.Black 3.Black	1.Yellowish 2.Red 3.White	1.Yellow 2.White 3.White	1.Sweet 2.Sweet 3.Sweet	1. Good for drying when high yield 2&3. Food reserve for hungry season	1&2&3. Can be harvested at 4-6 months, will produce large tuber at 10 months	1&2&3. Up to 1 year after which it will decompose
	Mahakidan	1. Mutin 2. Mantega	1. Ailuka bobe (Tetun Terik) 2. Ailuka modok	1&2. Since the time of our ancestors	1.Black 2.Black	1.Red 2.Yellowish	1.Yellow 2.White	1.Sweet 2.Sweet	1.Soft 2. Early harvest	1&2. 8 months	1. 1 year 2. 2-3 years (does not become bitter)
	Letefoho	1. Manu tolon 2. Mutin 3. Ornora 4. Moruk	1.Aih manteol (Mambae) Aih haleus 3. Aih Ornora 4. Aih lelu	1&2&3&4. Since the time of our ancestors	1.Black 2.Black 3.Black 4.Black	1.Yellowish 2.Red 3.White, red 4.White	1.Yellow 2.White 3.White 4.White	1.Sweet 2.Sweet 3.Sweet 4.Bitter (dried for consumption)	1. Early harvest 2. Large tuber 3. Large tuber 4. Food reserve for hungry season	1&2. 1 year 3. 10-12 months 4. 12 months	1. 2-3 years 2. 2-3 years 3. 1 year 4. 2-3 years

Fourteen respondents grew cassava, with each planting at least 3-4 varieties and as many as 5 (Selo Kraik) or 6 varieties (Maubaralisa). Respondents categorised cassava usually in terms of skin color (black/dark-red, coffee-colored), inner skin color (white, red, yellow), flesh color (white, yellow) or taste (bitter or sweet). Note that *Boraxia* or *Burasia* is a wild cassava type that is a distinct species to *M. esculenta*. It is described as having bitter tubers, in fact swollen roots, which are located further from the plant than cultivated cassava.

The cassava plant has several uses in Timor. The tuber is cooked for daily consumption, and dried as a food reserve for the hungry season. The leaves may be consumed as a leafy green. Raw tubers are fed to pigs, cooked tubers are fed to dogs, and grated tubers are fed to chickens. Stems of *Boraxia* cassava may be used as a living fencing material particularly for the house garden.

Elevation influences harvest time: the higher the elevation the longer duration between planting and harvest. On average, cassava grown in lowland coastal areas takes as little as 3.5-6 months, with slope areas taking approximately 9 months, and upland areas between 12-36 months. The period of time that cassava can remain in the ground without becoming bitter or decomposing differs according to variety and elevation. Generally, the higher the elevation the longer the period that cassava can remain in the ground without decomposing. For example, the mutin variety decomposes after 6 months in Gugleur (78m) but can remain in the ground for 3-4 years in Maubaralisa. Varieties that can remain in the ground for a long period of time at different elevations include: lowland ('mantega' 2-3 years in Mahakidan, and 'buraisa' 2 years in Gugleur), slopes ('nona metan' and 'bazartete' for 3.5-4 years in Selo kraik), and upland ('mutin' and 'fuik' 3-4 years in Maubaralisa).

Respondents in only two locations claimed that certain varieties were imported from Indonesia since 1975: black-skinned/white fleshed 'mutin' (Gariwai); black-skinned/white fleshed 'mean' (Gariwai); black-skinned/yellow-fleshed 'mentega' (Gariwai and Selo Kraik); and black skin/white fleshed 'moruk' (Selo kraik). Note that although these varieties are grown in many other areas, these respondents claimed that they were local varieties.

Five out of 14 respondents planted cassava twice yearly: in Baucau district (Vemasse tasi, Buroma), Liquica district (Gugleur), and Manufahi district (Mahakidan, Letefoho). The same varieties are planted in both seasons.

Each respondent was asked to explain the positive characteristics of the cassava varieties grown. Characteristics can be classified in terms of the following: taste (fragrant, sweet, soft, starch); reserve food for hungry season; early harvesting; yield; size; weevil resistant; animal food, and stems used as fencing material.

- Taste. 9 out of 14 respondents (64%) mentioned taste as a characteristic. Six respondents mentioned **fragrance** as a characteristic of the following varieties: black-skinned/white or yellow-fleshed 'mentega' (Gugleur, Dato, Loilubo, Manucasa, Lausi); coffee-skinned/white fleshed 'maukafir' (Lausi), black-skinned/white-fleshed 'mina morin' (Selo kraik) and black-skinned/white-fleshed 'bazartete' (Selo kraik). Five respondents mentioned **sweetness** as a characteristic of the following varieties: 'mentega' (Woelakama, Loilubo); black-skinned/white fleshed 'mutin' (Woelakama, Gariwai); white-fleshed 'kangko' (Dato); white-fleshed 'nona metin' (Dato); black-skinned/white-fleshed 'buraisa' (Woelakama); black-skinned/white-fleshed 'mean' (Gariwai), and black-skinned/white-fleshed 'maukafir' (Manucasa). Four respondents mentioned **softness** in six different varieties: black-skinned 'mina morin' (Selo kraik); black-skinned 'bazartete' (Selo kraik); black-skinned/white-fleshed 'mau kafir' (Manucasa); black-skinned/white-fleshed 'Lisboa' (Loilubo); black-skinned/white-fleshed 'manunho' (Loilubo), and black-skinned/white-fleshed 'mutin' (Mahakidan). The characteristic of '*rahun*' (meaning not stringy or watery but rather a dense, refined texture) was mentioned for four varieties: 'mentega' (Gariwai); black-skinned/white-fleshed 'mean' (Gariwai); black-skinned/white-fleshed 'mutin'

(Gariwai), and 'nona metan' (Daru Leten). Additionally, 'mentega' was mentioned by one respondent as good for making cakes/bread.

- Reserve food for hungry season. 50% or 7 out of 14 respondents mentioned storage as reserve food as a characteristic of several varieties: black-skinned/white-fleshed 'moruk' (Selo kraik, Letefoho, Maubaralisa); black-skinned/white-fleshed 'fuik' (Maubaralisa); black skinned/yellow-fleshed 'modok' (Dotik); black-skinned/white fleshed 'mutin' (Maubaralisa, Dotik); coffee-skinned/white-fleshed 'nona metan' (Lausi); black-skinned/white-fleshed 'buraisa' (Loilubo, Gugleur), mixed-color skinned/white-fleshed 'birapo' (Maubaralisa), and black-skinned/ white-fleshed 'mean' (Dotik). Additionally, the leaves of black-fleshed/white-skinned varieties 'mutin' and 'mean' were mentioned as good for eating by the respondent in Gugleur.
- Early harvest. While 4 out of 16 farmers (25%) mentioned quick harvest as a characteristic of several varieties, none of these were the most quickly harvesting across the entire sample, but were the comparatively earlier harvesting variety planted by each respondent. Those varieties harvesting most quickly in lowland coastal areas were 'mentega' in 3.5 months (Gugleur), and yellow, red and white varieties named for the color in 4-6 months (Dotik). In upland areas, 'mentega' harvested in 10 months (Maubara lisa) and black-skinned/white-fleshed 'mutin' in 10-12 months (Letefoho).
- Size. Two respondents mentioned large-size as a characteristic of two varieties: 'metan' (Daru Leten), and black-skinned/ white-fleshed 'mutin' (Letefoho).
- Resistant to pests. Two respondents mentioned pest resistance in two varieties: 'mentega' (Manucasa), and 'mutin' (Daru Leten).
- Animal food. The black-skinned 'nona metan' was mentioned as suitable animal food by the respondent in Gugleur.
- Fencing material. The stems of 'buraisa' were mentioned as good fencing material by the respondent in Maubaralisa.

7. Pigeon Pea (Tetum: tunis)

Pigeon pea (*Cajanus cajan*) is a widely-grown cultivar among small holder farmers across all agro-climatic zones in Timor. Pigeon pea is ideal for intercropping as its slow initial growth allows other crops to grow unhindered, and after the harvest of other crops, it grows rapidly utilising residual soil moisture (ICRISAT). In Timor, it is intercropped in the main garden with other staples such as maize, sweet potato, and cassava, as well as bananas, pumpkin, beans, and taro.

Pigeon pea can withstand an arid landscape, tolerating drought and high temperatures. Its deep woody tap root and lateral root system on the superficial layers of the soil allows it to optimise moisture and utilise nutrients and in doing so, improves the soil structure. It is mostly consumed as a split dhal, but can also be used for soil conservation and animal fodder (ICRISAT).

Protein-rich legumes are integral to cropping systems which are sustainable, and important for upland areas where the majority of farmers depend on dryland crops (Piggin and Palmer 2003).

7.1 Planting times

Table 76. Pigeon pea: first season planting times by village

District	Sub-District	Village	Elevation	First season planting	First season harvest
Aileu	Aileu	Lausi	906m	November	April (green), May (ripe)
	Aileu	Seloi kraik	1077m	November	June to July
	Liquidoe	Manucasa	1363m	October	March (small), May to June (large)
Baucau	Vemasse	Loilubo	770m	November	February (short season pigeon pea variety), June (large variety)
	Vemasse	Woelakama	225m	October to November	August to September
Liquica	Liquica	Daru Leten	1241m	November	August
	Maubara	Gugleur	78m	December	July to September
	Maubara	Maubaralisa	998m	End of November	June (green), end of June to July (ripe)
	Maubara	Vatuvou	9m	November	May to June
Manufahi	Alas	Dotik	20m	December	July to August
	Alas	Mahakidan	20m	December	August
	Same	Letefoho	408m	November	March (small, green), April (large, green) End of April (small, ripe), end of May to June (large, ripe)

All pigeon pea planted at the beginning of the wet season is planted on saturated ground, either after maize has been planted or at the same time, that is, as part of the same planting activity. The only exception is Manucasa where in large gardens, pigeon pea is planted before maize. Harvest times depend on whether the variety is harvested green or ripe, and whether the variety is large or small.

Table 77. Pigeon pea: second season planting times

District	Sub-district	Village	Elevation	Planting	Harvest
Baucau	Vemasse	Loilubo	770m	April	June
Manufahi	Same	Letefoho	408m	April to May	June to August

Pigeon pea was planted in only two locations of this study during the dry season. Irrigation was not necessary as planting took place in Loilubo at the tail end of the rainy season when occasional light rain occurred, and in Letefoho during the second short wet season.

7.3 Planting

Seed selection

The characteristics of seed selected for planting are: rounded, clean, bruchid-free. Pigeon pea is intercropped with other staples and vegetables in the main garden. In two coastal locations (Dotik and Gugleur), respondents planted pigeon pea in the same hole as maize and long beans.

Iron crowbars are used for making the planting hole for pigeon pea. More than one seed is planted in each hole, with the quantity differing from place to place: 1-2 seeds (Letefoho, Vatuvou); 2 seeds (Seloikraik, Dotik, Maubaralisa, Woelakama, Loilubo); 2-3 seeds (Manucasa and Daru leten); 3 seeds (Mahakidan), and 3-4 seeds (Gugleur). There is no correlation between elevation and the number of seeds planted.

Using a meter rule to approximate distance, planting distances ranged from 50cm to 2m, with the lower range considerably shorter than 1.5-2 metres expected by SoL agronomists. There was no relationship between elevation and planting distance. All respondents except Dato closed the planting hole over either using the foot, or the tapered end of a digging stick.

Farmers plant pigeon pea either after maize has been planted (e.g., Lausi, Seloikraik, Maubaralisa, Daru Lete) or at the same time and in the same garden where maize is planted (e.g., Loilubo, Woelakama, Gugleur). The one exception is Manucasa where farmers with large plantings of maize plant pigeon pea first, then maize.

Table 78. Pigeon pea: planting distance by village

Village	Distance ¹¹
Seloikraik	1m-1.20m
Lausi	1m-1.55m
Manucasa	78cm-1m
Lete foho	1m-2m
Mahakidan	80cm
Dato	85cm-1.5m
Daru leten	50-60cm
Maubara lisa	1.50m-2m
Gugleur	50cm-1m
Vemasse tasi	1m
Loilubo	1.50m-2m

Weeding

Weeds are slashed using machete or sickle, or hoed, or the roots dug out. Slashed weeds may be used for humus and piled around the plant base (e.g., Gugleur, and in Manufahi district). In Loilubo, weeds are spread over the garden if there is strong sun, or piled in a heap if there is insufficient sunlight. Both of these methods aim to avoid re-growth.

Harvest

Harvesting is done by hand and peas stored in a sack in the house.

¹¹ Using meter ruler as reference

Drying system

Pigeon pea is dried by spreading out on a woven mat or tarpaulin in the sun for several days depending on the strength of the sun. After drying, the peas are poured into a sack and shelled using one of several methods:

- punching the sack with a wooden stick or stone: Manucasa, Selo kraik, Dotik, Vatuvou, Daru leten, Gugleur
- punching the sack with one's hand: Lausi, Mahakidan, Maubaralisa
- removing or peeling the shell by hand: Letefoho, Woelakama
- stepping on the pea on a woven mat: Loilubo

Storage

Several methods are used to store peas set aside as seed for planting:

- in a second-hand drum
- in a jerry can
- in a sack stored in the house
- in a plastic 1.5 litre water bottle or a glass bottle
- in a length of bamboo

Nearly all respondents shelled pigeon pea prior to storing seed for planting and for consumption. (The exception is Mahakidan in Manufahi district where peas are stored in their shells for consumption and planting, and Betano where peas may be stored either shelled or unshelled.) The method of storing pigeon pea as seed for planting, or for consumption, is usually the same.

Table 79. Pigeon pea: methods for storing seed for planting, and for consumption, by village

Village	Storage methods for pigeon pea set aside for consumption	Storage methods for pigeon pea set aside as seed for planting
Selo kraik	Shell the pea first then place in bag inside second-hand drum	Dry the pea, shell it, then place in bag inside second-hand drum
Manucasa	Shell the pea first then store in a bag	Remove the shell and store in jerry can
Loilubo	Shell the pea first then store in a bag	Shell the pea first then store in bag
Woelakama	Shell the pea [respondent does not consume pigeon pea because of food taboo]	No storage because pigeon pea consumption is taboo for men - seed for planting is sourced from others
Daru Leten	Shell the pea and store inside bamboo (described by respondent as 'traditional' method), or in a glass bottle or plastic bottle [described as 'modern']	Remove the shell, and store in bamboo, or in a plastic jerry can
Gugleur	Shell the pea first then place in bag and store in jerry can or glass bottle	Shell first then place in jerry can or glass bottle
Maubaralisa	Shell the pea first then store in bag or jerry can	Shell first then place in glass bottle or plastic bottle
Vatuvou	Shell the pea and store in a bag where other reserve food is stored	Shell the pea and store in jerry can or a bag if large quantity
Dotik	Shell the pea and store in a bag	Shell the pea then place in a bag and store above the kitchen hearth
Mahakidan	Store the unshelled pea in a bag	Place the unshelled pea in a bag and store inside the house
Letefoho	Shell the pea and store in a bag	Shell the pea then place in a bag and smoke/store above the kitchen hearth
Betano	Store the unshelled pea in a bag	Remove the shell or store the pea unshelled

7.4 Division of labour for pigeon pea cultivation

The mixed household group is the dominant labour formation for cultivating pigeon pea across all areas. In some areas, gender-restricted household groups (women only household groups) are dominant (e.g., Woelakama, Selo kraik). For the activity of weeding, mutual labour exchange is the dominant labour formation across all areas.

Mixed household groups

Most activities associated with cultivating pigeon pea are carried out by mixed household groups, particularly drying (66% or 8 out of 12 respondents), harvesting (up to 50% or 6 out of 12 respondents including 1 respondent using either a *mixed* household group or mutual labour group), seed preparation (50% or 6 out of 12 respondents), and planting (up to 50% or 6 out of 12 respondents including 1 respondent using either a *mixed* household group or mutual labour group), and weeding (up to 33% or 4 out of 12 including 3 respondents who used either a *mixed* household group or mutual labour group).

Table 80. Pigeon pea: activities carried out by mixed household groups

Commodity	Number of farmers	Seed/runner preparation	Planting	Weeding	Harvesting	Drying
Pigeon pea	12	50%	50%	Up to 33%	Up to 50%	66%

Gender restricted household groups

Gender-restricted household groups, particularly women-only household groups, undertake several tasks associated with cultivating pigeon pea: preparing seed (45% or 5 out of 11 respondents), and planting, harvesting and drying (each 25% or 3 out of 12 respondents). Additionally, in Dotik, planting is undertaken by a women-only mutual labour group. Particularly striking is the extent to which activities associated with cultivating pigeon pea in Woelakama are entirely undertaken by women-only household groups. To a lesser extent this is also the case in Selo Kraik. In all areas however, women-only household groups involved in pigeon pea cultivation may be assisted by men where there is insufficient labour (except among some Mambae speakers in Same where planting is done by women only as it is believed that if men are involved the pea will not form properly in its pod).

Given that women also comprise members of mixed household groups, it can be said that across all areas women are involved in all activities associated with pigeon pea cultivation. The implication is that women must be targeted in any extension activity in relation to pigeon pea production.

Table 81. Pigeon pea: activities carried out by women-only household groups

Commodity	Number of farmers	Preparing seed	Planting	Harvesting	Drying
Pigeon pea	12	45%	25%	25%	25%

Mutual labour exchange

Mutual labour groups are mainly used for weeding (41% or 5 out of 12 respondents), and to a much lesser extent, planting and harvesting (16% or 2 out of 12 respondents). However, if we include those respondents who use *either* household groups or mutual labour groups, it can be said that as many as 75% (9 out of 12 respondents) use mutual labour groups for weeding, and 25% (3 out of 12) for planting and harvesting.

Table 82. Pigeon pea: activities carried out by mutual labour groups

Commodity	Number of farmers	Planting	Weeding	Harvesting
Pigeon pea	12	Up to 25%	Up to 75%	Up to 25%

7.5 Pigeon pea varieties

Table 83. Variety table for pigeon pea

District	Village	Variety in Tetun Language	Name of variety in Local Language	Length of time planted	Colour of skin	Color of seed	Size of bean	Reasons for growing this variety	Duration planting until harvest	Length of time can remain on the bush before decomposes
Aileu	Lausi	1.Tunis bo'ot 2.Tunis ki'ik	1.Tuir tun (Mambae) 2. Tuir loban	1. Since the time of our ancestors 2. Two years (since 2004)	1&2. Black when dried, green when unripe	1&2. Black, speckled white	1. Large 2. Small	1. Cook with maize 2. Seed similar to maize kernel	1. 5-6 months 2. 4 months	1&2. After 1 month will decompose on the bush
	Seloi kraik	1.Tunis metan 2.Tunis makerek 3.Tunis mutin	1.Tuir metan (Mambae) 2. Tuir makerek 3. Tuir butin	1&2&3. Since the time of our ancestors	1&2&3. Black when dried, green when unripe	1.Black 2. Speckled 3.White	1.Medium 2.Medium 3.Large and small	1&2&3. Tasty, do not tire of the taste	1&2&3. 8-9 months	1&2&3. 9 Months
	Manucasa	1.Tunis ki'ik 2.Tunis bo'ot	1.Tuir maus (Mambae) 2.Tuir tuun	1&2. Since the time of ancestor	1&2. Black when dried, green when unripe	1&2. White and black	1. Small 2. Large	1.Early harvest 2.High yield, big stems	1. 4-5 months 2. 6-8 months	1. 10-11 months 2. 1-2 years
Baucau	Loilubo	1.Tunis bo'ot 2. Tunis lais	1.Utu uru (Waimua) 2. Uto uru lahi	1. Since the time of our ancestors 2. 1 year (since 2005)	1&2. Black, speckled	1&2. Black, white and red	1&2. Medium	1. Disease resistant, used as traditional medicine for <i>sarampu</i> , cook when green as vegetable 2. Early harvest, fragrant	1. 8 months 2. 3 months	1. 2 months 2. 2 months
	Woelakama	Makerek	Utu uru (Waimua)	Since the time of our ancestor	Green when young, and speckled when dried	Speckled white and black	Large	Missing data	11 months	± 12 months
Liquica	Daru Leten	1.Tunis kinur 2.Tunis mutin	1.Turi gemen (Tokodede) 2.Turi buti	1&2. Since the time of ancestor	1&2. Red when ripe, black when dried	1. Yellow 2. White	1&2. Medium	1.Fragrant 2.Fragrant	1&2. 9 months	10 months
	Gugleur	1. Tunis metan 2. Tunis mutin 3. Tunis makerek	1.Turi meta (Tokodede) 2. Turi buti 3. Turi brikat	1&2&3. Since the time of our ancestors	1.Black when dried 2. Black when dried 3. Black when young, speckled when dry	1. Black 2. White 3. Speckled	1. Medium 2. Medium 3. Medium	1&2&3. Fragrant like other beans when cooked with maize	1&2&3. 7-8 months	1&2&3. 5-6 months

Table 83. Continued

District	Village	Variety in Tetun Language	Name of variety in Local Language	Length of time planted	Colour of skin	Color of seed	Size of bean	Reasons for growing this variety	Duration planting until harvest	Length of time can remain on the bush before decomposes
	Maubaralisa	1.Tunis metan 2.Tunis mutin 3.Tunis kinur 4.Tunis makerek	1.Turi meta (Tokodede) 2.Turi buti 3.Turi mege 4.Turi brikat	1&2&3&4. Since the time of ancestor	1.Black 2.Yellow/speckled 3.Yellow/speckled 4.Speckled	1. Black 2. White/yellow 3. White 4. White	1. Medium 2. Medium 3. Medium 4. Medium	1&2&3&4. Sweet taste when cooked with maize and other vegetables	1&2&3&4. 6-7 months	1&2&3&4. Will decompose after 2 months
	Vatuvou	Tunis	Turi (Tokodede)	Since the time of our ancestors	1.Black when dried, speckled when ripe	1.Speckled, white, red	1.Medium	Fertilises the soil, supresses blady grass (malai), reduces the bitterness of other vegetables when cooked together (e.g., pawpaw leaves)	4-5 months	6-7 months
Manufahi	Dotik	1.Tunis metan 2.Tunis makerek 3. Tunis mutin 4. Tunis mean	1.Turis metan (Tetun Terik) 2. Tunis makerek 3. Tunis mutin 4. Tunis mean	1&2&3&4. Since the time of our ancestors	1.Speckled 2.Speckled 3.Speckled 4.Speckled	1.Black 2.Speckled 3.White 4.Red	1.Large 2.Large 3.Narrower 4.Large	1&2&3&4. Disease resistant, and long storing	1&2&3. 7 months 4. 7-8 months	1&2&3&4. 2.5 years
	Mahakidan	Tunis	Tunis (Tetun Terik)	Since the time of our ancestors	Speckled	Black, white and speckled	Large and small	Can sate one's appetite	8 months	1 year
	Letefoho	1.Tunis bo'ot (naruk) 2. Tunis ki'ik (badak)	1.Tuir tu'u (naru) (Mambae) 2. Tuir loba (bada)	1&2. Since the time of our ancestors	1 &2. Black when dried, speckled yellow when unripe	1 & 2. Black, white, speckled	1. Large 2. Small	1&2. Disease resistant	1. 6 months 2. 4 months	1&2. Decomposes after 6 months on the bush

Twelve respondents planted pigeon pea with most planting at least one variety, and some planting as many as 4 varieties (Dotik) or 5 varieties (Maubaralisa). Farmers categorise pigeon pea according to skin-color when unripe, mature, and dried; color of the pea, and size. Size corresponds with harvest time, that is, small varieties are harvested in a short amount of time and may be categorised as a quick variety, and large varieties take longer to harvest. Based on the data to hand there does not appear to be a correlation between harvest time and elevation.

Pigeon pea can be consumed fresh (i.e., uncooked), the young or green bean can be boiled with maize, and the dried bean can also be cooked. The stems of the pigeon pea bush may be used as fire wood, burned to become ash fertiliser, and mixed with pea skins to make humus.

In most locations respondents planted local varieties except in Seloikraik (small, black and white variety introduced in 2004), and Loilubo (small, white variety introduced in 2005).

Each respondent was asked to explain the positive characteristics of the pigeon pea varieties grown. Characteristics can be classified in terms of the following: taste (sweetness, fragrance); disease resistant; early harvesting; long storing; suppresses blady grass (*manlae-imperata cylindrical*); fertilizes soil, and traditional medicine.

- Taste. 50% or six out of 12 farmers mentioned taste as a characteristic. Respondents in Seloikraik and Lausi mentioned the following varieties as tasty to eat: black pea 'metan', speckled pea 'makerek', and white pea 'mutin'. Three respondents mentioned the following varieties as **fragrant**: white pea 'mutin' (Maubaralisa, Daru leten, Loilubo), yellow pea 'kinur' (Daru leten, Maubaralisa), black pea 'metan', white pea 'makerek' and red 'mean' (Maubaralisa). Two respondents mentioned the following varieties as **sweet**: red 'mean' (Maubaralisa, Vatuvaio); white 'mutin' (Maubaralisa, Vatuvaio); white or yellow pea 'makerek' (Maubaralisa, Vatuvaio); black pea 'metan' (Maubaralisa), and white pea 'kinur' (Maubaralisa).
- Disease resistant. 25% or three out of 12 respondents mentioned disease resistance as a characteristic of the following varieties: speckled 'makerek' (Dotik, Loilubo), black pea (Loilubo), white pea (Loilubo), red pea (Loilubo), and black & white pea (Letefoho).
- Early harvest. Two respondents mentioned two varieties as early harvesting: a white and black variety that harvests in 4-5 months (Manucasa), and a white 'mutin' variety that harvests in 3 months (Loilubo).
- Long storing. One respondent (Dotik) mentioned the following varieties as storing well: black pea 'metan', speckled pea 'makerek', white pea 'mutin', and red pea 'mean'.
- Suppresses blady grass. One respondent (Vatuvaio) mentioned the following varieties as acting as a ground cover to smother blady grass: speckled 'makerek', red 'mean', and white 'mutin'.
- Fertiliser. The respondent from Vatuvaio claimed that the same variety that suppressed blady grass also fertilised the soil i.e., speckled 'makerek', red 'mean', and white 'mutin'.
- Traditional medicine. One respondent (Loilubo) mentioned the large, white & black variety used as a traditional medicine for the skin disease *sarampu*.

CONCLUSION

This report offers data on cultivation practices, species varieties, labour formations, and religious rituals for six commodities across different agro-climatic zones in four districts. It is only a preliminary survey, and the authors have aimed to describe and analyse patterns and anomalies. Approximately nine 120-minute interviews were carried out with respondent households in 17 villages across eight sub-districts. Respondents were identified from lowland, sloping and upland areas in each district, and maize-dominant and rice-dominant farmers were selected. In many of the interviews, members of respondents' extended family and neighbours attended and participated in the interview discussion.

While the data on cultivation practices and species variety characteristics are elaborated in the individual commodity sections in this report, further insight about labour formations and religious rituals can be gained through a comparative analysis.

Labour formations

Household groups and gender

Except for a few gender-restricted activities in certain locations, women and men are involved in nearly all activities associated with cultivating maize, rice, sweet potato, cassava, peanuts and pigeon pea. Activities that require low labour input mobilize labour within the nuclear household (husband, wife and unmarried offspring), while activities that are more labour intense, particularly in relation to rice, draw labour from extended family (sons-in-law, household head's elder and younger male siblings) living nearby. This fact highlights the household-based nature of farming in East Timor, and the strongly kin-based character of East Timorese settlements.

Based on the data of this research, gender-restricted groups, that is women only/men only groupings, were usually due to the physical nature of the task and its labour intensity. Anecdotal evidence suggests however that gendered division of labour may also be influenced by local belief systems and custom. For example, among some language groups only women are permitted to plant pigeon pea as it is believed that male contact will render the seed sterile. Women-only household groups which draw on women members of the household as well as the extended family are active particularly for seed preparation, and post-harvest processing and storage. Given that there are no male-only household groups undertaking activities associated with pigeon pea, peanuts and cassava, it can be said that women – either as members of mixed household groups or as members of women-only household groups - are involved in all activities associated with these three commodities.

The extent of women's involvement in seed preparation and post-harvest processing for all commodities, and for all cultivation activities related to pigeon pea, peanuts, and cassava, dictates that women should be targeted equally with men in any extension activity, and particularly in relation to seed preparation, storage of seed for planting, and processing and storage technology.

Table 84. All commodities: use of women-only household groups

Commodity	Number of farmers	Preparing seed/runners	Transplanting	Planting	Harvesting	Drying	Winnowing	Storing
Maize	16	80%	n/a	6%	12%	12%	n/a	30%
Upland rice	5	40%	0%	0%	40%	n/a	0%	20%
Irrigated rice	8	Not avail	12%	0%	0%	n/a	12%	25%
Sweet potato	14	36%	n/a	7%	25%	7%	n/a	7%
Peanuts	13	71%	n/a	42%	0%	28%	n/a	35%
Cassava	14	7%	n/a	7%	21%	22%	n/a	44%

Pigeon pea	12	45%	n/a	25%	25%	25%	n/a	0%
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Table 85. All commodities: use of mixed-household groups

Commodity	Number of farmers	Garden/ricefield preparation	Seed/runner preparation	Propagate seedlings	Planting	Weeding	Controlling for birds	Harvesting	Drying	Threshing
Maize	16	Up to 37%	20%	n/a	12%	Up to 50%	n/a	Up to 43%	58%	
Upland rice	5	Up to 20%	40%	n/a	40%	40%	n/a	Up to 40%	0%	Up to 100%
Irrigated rice	8	Up to 42%	Not avail	100%	Up to 12%	Up to 42%	85%	Up to 12%	0%	
Sweet potato	14	0%	45%	n/a	92%	Up to 83%	n/a	75%	83%	
Peanuts	13	0%	30%	n/a	38%	Up to 92%	n/a	Up to 100%	77%	
Cassava	14	0%	64%	n/a	Up to 78%	0%	n/a	71%	66%	
Pigeon pea	12	0%	50%	n/a	50%	Up to 33%	n/a	Up to 50%	66%	

Mutual labour exchange groups

Every respondent in this study was a member of a mutual labour exchange group. The form of mutual labour exchange varies according to area and commodity but the most common form is simple rotational labour where the group rotates in each member's garden to complete an activity such as weeding maize. The constitution of mutual labour exchange groups has a basic pattern: members comprises nuclear household and extended family members, as well as (non-kin) neighbours whose gardens are proximate. Particularly for maize and rice, mutual labour exchange groups are critical for cultivation activities such as garden and ricefield preparation, planting, weeding, and harvesting. To a much lesser extent, mutual labour groups are used for the weeding and planting of sweet potato, cassava, peanuts, and pigeon pea.

The use of wider reciprocal labour exchange networks is a common feature of Timorese farming communities and points to the thoroughgoing inter-dependency of Timorese households on extended family ties and the resources that may be mobilized and re-distributed through these institutionalized networks.

Given the high level of participation by farmers in these groups, and familiarity with each other's gardens, it may be expected that the mutual labour group will be a key distribution mechanism for adoption, that is, OFDT farmers will pass SoL varieties to fellow mutual labour group members if there is sufficient seed. These groups also constitute functioning work collectives suitable for distribution of other technologies or extension activity.

Table 86. All commodities: use of mutual labour exchange groups

Commodity	Number of farmers	Garden preparation	Planting	Weeding	Threshing	Harvesting
Maize	16	Up to 80%	81%	44%	n/a	Up to 62%
Upland rice	5	60%	60%	40%	0%	40%
Irrigated rice	8	75%	75%	60%	60%	50%
Sweet potato	14	0%	0%	Up to 33%	n/a	0%
Peanuts	13	0%	21%	Up to 28%	n/a	0%
Cassava	14	0%	Up to 28%	Up to 42%	n/a	0%
Pigeon pea	12	0%	Up to 25%	Up to 75%	n/a	Up to 25%

Ritual activity

What is striking about the respondent data on the prevalence and forms of ceremonial activity associated with maize and rice, is its widespread practice. It is apparent that nearly all communities allocate resources and time to conduct ritual observances. Given the small holdings of livestock by Timorese farmers - farmer households own 5.8 chickens on average, 2.8 pigs and 4.4 goats or sheep (WFP 2006) - ritual sacrifice of livestock demonstrates the significant investment cost of farming.

Ceremonial activity is likely to be a feature of contemporary agriculture across East Timor and highlights the continuing vitality and significance of customary beliefs and obligations for households as members of ritual houses. The extent of ritual practice also reflects a generalised traditional response to risk and uncertainty in agriculture.

Table 87. Ritual activity by commodity

Commodity	Number of respondents interviewed who planted this commodity	Number of respondents practicing ritual activity	Average number of ritual activities per cultivation cycle
Maize	16	75%	2-3
Upland rice	5	100%	2
Irrigated rice	8	100%	4
Peanuts	13	15%	1-2

Feedback from some Timorese agronomists during the course of this research suggested that ritual beliefs and practices may affect farmers' adoption of new technology such as new varieties or cultivation techniques. However, it would appear to the authors of this study that rituals are not tied to particular varieties of a species, or to a particular cultivation technique. Rather, these rituals are tied to the stages of development that a plant passes through. Proper performance of the ritual is hoped to bring about a subsequent stage such as germination, flowering, or development of the tuber - leading towards successful harvest. The ritual is performed in response to the plant reaching the threshold of another stage. Given this, and given the prevalence of customary beliefs, regardless of the variety or cultivation method, a farmer will continue to perform the ritual when the plant passes through these stages in order to sure up the success of the harvest. This is probably due to the fact that farmers believe that success or otherwise is determined in part by the will of the ancestors and the spirit custodians of the land. The extent of ritual activity among OFDT farmers participating in this study offers further evidence that ritual practice does not preclude adoption of new technologies.

Performance of rituals at specific times in the development of maize or rice crops (as elaborated in Tables 17, 27 and 38) demonstrate that ritual houses and ritual elders are integral to the cultivation cycle of the staple foods maize and rice. Ritual activity may be centred in the ritual house and conducted by the ritual elder who is custodian of the ritual house to which a farmer is affiliated, or in a farmer's garden or ricefield. Other member households affiliated with a farmer's ritual houses may attend agricultural rituals. The ritual house is therefore a social network that is integral to agricultural production in general, and maize and rice in particular. As a social formation which is a smaller unit than the hamlet (a hamlet comprises several ritual houses), ritual houses and their affiliated households could be used as a network through which to disseminate new technologies and carry out extension activity. Further, given the central role of ritual elders in conducting religious rituals in relation to cultivating staple foods, it would be pertinent to invite ritual elders in locations where SoL is implementing OFDTs, to participate in trials, field days and other SoL activities.

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