Revista Científica

VERITAS

Universidade Nacional Timor Lorosa'e (UNTL)

Programa de Pós-Graduação e Pesquisa
Unidade de Produção e Disseminação do Conhecimento

VERITAS

Revista Científica da Universidade Nacional Timor Lorosa'e

Índice

Editorial

Este número dedica-se aos assuntos de *mudança climática, produção e mercado dos produtos agrícolas*. Trata-se de uma edição que apresenta os resultados de pesquisa dos docentes e investigadores da Faculdade de Agricultura da Universidade Nacional Timor Lorosa'e. Certo que os textos de pesquisa apresentados aqui é o resultado de um esforço da colaboração mútua entre os professores-investigadores da Faculdade de Agricultura e a Unidade de Produção e Disseminação do Conhecimento do Programa de Pós-Graduação e Pesquisa da UNTL.

Sabendo que a agricultura é um setor muito importante para a sustentabilidade económica de Timor-Leste, tendo como pano de fundo um setor agrícola vibrante e produtivo com o objetivo de aumentar ainda mais a produtividade para atender às demandas crescentes de alimentos no nível local, nacional e regional.

O potencial impacto adverso das mudanças climáticas sobre agricultura timorense (devido a seca prolongada, as áreas produtivas de Maliana, Vemasse de Baucau, Natarbora de Manatuto, Oé-Cussi e outras zonas produtivas não conseguem produzir muitos produtos de agrícolas) e a subsistência a ela associada também é uma questão sobre a qual o Governo timorense (especialmente o Ministério de Agricultura e Pescas) tem dado especial atenção, conforme apresentado no seu plano político anual.

Para alcançar o desenvolvimento nacional, a segurança alimentar, a adaptação e a atenuação das mudanças climáticas, assim como as metas comerciais nas próximas décadas, Timor-Leste precisa elevar de forma significativa a produtividade por área dos sistemas de cultivo de produtos alimentícios. "Uma vez que a produção de alimentos não é condição suficiente para garantir a segurança alimentar, isso significa que a forma como estamos produzindo não é mais aceitável", pois "O que ainda vemos é, principalmente, um modelo de produção que não impede a degradação dos solos e a perda de biodiversidade – ambos bens essenciais, especialmente para as gerações futuras" e tal modelo deve ser revisto com responsabilidade moral e social no enquadramento da "mudança de paradigma" com perspetiva "sustentável, inclusivo e resiliente"[1].

Dezembro de 2015
Editor-Chefe
Vicente Paulino

---

[1] José Graziano da Silva, Diretor Geral da Organização das Nações Unidas para a Alimentação e a Agricultura (FAO) - http://blog.zerohungerchallenge.org/we-need-a-paradigm-shift/ (acesso em 30/11/2015).

Revitalizasaun Kafé Hibridu Timor iha distritu Ermera

Vicente de Paulo Correia
Osorio F.Verdial
Donata O. de Araujo
Lucio Marcal Gomes
Agostinhó Moniz
Julio de Deus Gomes[*]

Rezumu

Kafé Hibridu Timor (HDT), nu'udar kafé espesiál ida ne'ebé hanesan orijen Timor nian, tamba akontese iha Timor nó naturalmente husi kruzamentu entre kafé Arabika hó kafé Robusta, mezmu ke kromosomas variedade rua ne'e la hanesan. Hanesan ai-hóris ne'ebé úniku nó ezotiku, karakteristikamente reziste kontra atake husi *ular-oan* (bichó) nó vírus ruma, liu-liu *Helemmia vastatris sp.* Objetivu husi estudu ne'e mak atu halo revitalizasaun ba HDT atu bele salvaguarda kafé-inan iha futuru. Prosesu revitalizasaun kafé ne'e hala'o hó modelu rua inklui koko atu habarak liu husi HDT nia musan nó mós habarak liu husi stek (estacas).

Liafuan-xave: Hibridu, kafé, revitalizasaun, eztinsaun, sobrevivénsia

Resumo

Café Hibrido de Timor (HDT) é uma produção única e original em Timor. Só existe neste país, porque é criado a partir de um casamento cruzado entre café Arabica hó kafé Robusta, mesmo que os cromosomas não são iguais. É uma planta única e exótica, caracteristicamente resiste kontra ataques das pragas e doenças, especificamente *Helemmia vastatris sp.* Objetivo deste estudo é para fazer revitalização ao HDT, de modo a poder salvaguardar café-mãe no futuro. Processo de revitalização café deve ser realizado com a aplicação de dois modelos através frutos sementeiros e duplicação de estacas.

Palavras-chaves: Café hibrido, revitalização, extinção de sobrevivência

---

[*] Docentes Faculdade de Agricultura, UNTL.

Abstract

Hybrid Coffee Timor (HDT) is a unique and original production in Timor. There is only in this country, as a result of a marriage between cuzado Arabica coffee Robusta hó Kafé, even if the chromosomes are not equal. It is a unique and exotic plant characteristically resists kontra attacks of pests and diseases, specifically Helemmia vastatris sp. This study aims to revitalize the HDT, so as to safeguard parent coffee in the future. Coffee revitalization process should be carried out with the use of two models by seed producer's fruit and duplication stakes.

Keywords: hybrid Café, revitalization, survival extinction

Revitalizasaun Kafé Hibridu Timor iha distritu Ermera

Introdusaun

Timor-Leste nudar país nó nasaun foun ida ne'ebé moris iha era millenium, persiza dezenvolve-an tuir ritmu dezenvolvimentu globál mundu rai klaran. Vizaun ida ne'e lori Timor-oan tomak enkara desafiuz boot, ne'ebé só bele alkansa iha komprimisu ida ne'ebé konsistente tebes, katak Timor-oan bele nó prontu hódi integra-an ba prosesu dezenvolvimentu. Prosesu dezenvolvimentu, kobre áreas barak hó nia dimensaun ida luan, maibé bazeia ba kondisaun atual presiza defini áreas prioridades ne'ebé bele asegura kualidade moris Timor-oan nian nó mós fó vantajen benefisiu atu nune'e Timor-oan sira bele sente moris ne'e hó di'ak.

Área prioridade prinsipál ida mak setór agrikultura. Área ne'e sustenta ai-han hanesan primeira nesesidade baziku povu Timor tomak hódi suporta moris loron- loron nian tamba Timor-oan kuaze 85% moris hanesan agrikultór ne'ebé subsistente. Maibé, era revolusaun verde ne'ebé akontese nó era globalizasaun loke perspektiva foun ba ema mundu tomak hó expansaun sientifika i teknolojia fó esperansa boot katak agrikultura foun nó modernu sei suporta povu tomak ba moris iha prosperidade nia laran.

Hó akontesimentu ida ne'e, aumenta nó loke mós orizonte Timor-oan nian liu-liu koñesimentu sientífiku ida luan hódi dezkobre riku-so'in balun iha rai laran. Koñesimentu sientífiku ba dezkobrimentu riku-so'in ne'e reflekte liu bá plantasaun exótika/naturál sira hanesan: *"Kafe Hibridu Timor" (HDT)*.

Literariamente HDT*,* mak café ida ne'ebé espesiál hanesan orijen Timor nian, tamba akontese naturálmente nó husi kazamentu kruzadu husi kafé *Arabika* hó kafé *Robusta* ne'ebé sira nia kromosoma ne'e diferente tebes, nó mós hanesan ai-hóris ne'ebé úniku e exotiku. Karakteristika seluk tan, reziste kontra atakes husi *ular-oan* (bichó) nó vírus ruma hanesan *Helemmia vastatris sp.* Tamba ne'e, HDT iha futuru sei sai hanesan fonte renovável nó suporta sustentabilidade ekonomia nasionál hamutuk hó fonte sira seluk mak rikeza naturais irenovaveis hanesan mina, gás nó seluk-seluk tan. Maibé, devidu limitasaun ba tempu, apoiu orsamentu limitadu nó pesoál tekniku kualitativu sira, riku-so'in ne'e ladun hetan atensaun maximu ba nia dezenvolvimentu revitalizasaun fini sira nó plantasaun *mudas* ba expansaun HDT iha rai Timor.

Viza ba situasaun ida ne'e, espesialmente ekipa dosente ne'ebé kompostu husi departamentu rua hanesan departementu Agronomiku nó Agro-socio Ekonomika hamutuk hó dosente ECTI sente hanesan desafiu boot nó mós hanesan preokupasaun jerál rai laran, talvez mós hanesan problema inerente ba ministeriu kompetente. Ne'e duni, ami hanesan parte integrál ba dezenvolvimentu agrikultura iha rai laran, hó ne'on hó laran hakarak atu atualiza-an diretamente ba prosesu revitalizasaun fini sira nó

plantasaun *mudas* ba expansaun HDT iha rai laran atu nune'e bele salva guarda riku-so'in orijinál Timor nian atu nune'e labele lakon, nó loron ida ita hein katak kafé ida ne'e sei sai mós hanesan *Direito Patente* Timor ninian.

Identifikasaun Problemas

- Revitalizasaun fini sira nó *plantas mudas* hó nia prosesu tomak sei sai hanesan preokupasaun jerál ba entidade kompetente sira nó agrikultór tomak iha Timor-Leste. Teknikamente, ladun iha atensaun maximu ba revitalizasaun fini sira nó *plantasuan foun* HDT.
- Timor-oan ne'ebé 85% integradu iha setór agrikultura nó entidades kompetentes relevantes seida'uk orienta nia vizaun ba dezenvolvimentu HDT hanesan perspektiva foun ne'ebé bele salva guarda nó asegura integridade ba nia orijinalidade.
- Ekonomikamente agrikultór sira seida'uk hatene reseitas nó valór ekonomiku ne'ebé HDT sei oferese.

Objetivu

Objetivu jerál husi estudu ne'e mak atu halo revitalizasaun ba HDT atu bele salvaguarda café inan ne'e ba estudu loron oin mai nian nó melloramentu. Objetivu espesifiku mak atu:

- Habelar nó hakle'an koñesimentu sientifiku nó teknolojia konabá dezenvolvimentu revitalizasaun fini sira nó *plantas mudas* HDT;
- Reprodús nó dezenvolve revitalizasaun fini sira nó *plantas mudas* HDT hódi hasa'e produtividade, hó ámbitu ida atu eleva reseita ekonomika ba agrikultór sira;
- Dezenvolve metudu espesífiku adekuadu nó parametru sira relevantes hódi asegura vizibilidade implementasaun ba revitalizasaun fini sira nó *plantas mudas* HDT.

Metodolojia peskija
Tempu nó fatin ba peskija

Estudu ne'e realiza durante kuaze tinan ida nia laran komesa husi fulan Marsu to'o Novembru 2014. Fatin implementasaun ba peskija ne'e mak distritu Ermera, subdistritu Hatulia, suku Fatubesi, aldeia Matanova (haree mapa), depois halo implementasaun tratamentu komprova komparasaun fini sira nó *plantas mudas* entre Hibridu Timor, Arabika Robusta nó Moka iha área East Timor Coffee Institute (ECTI) Gleno,Sub-Distritu Ermera.
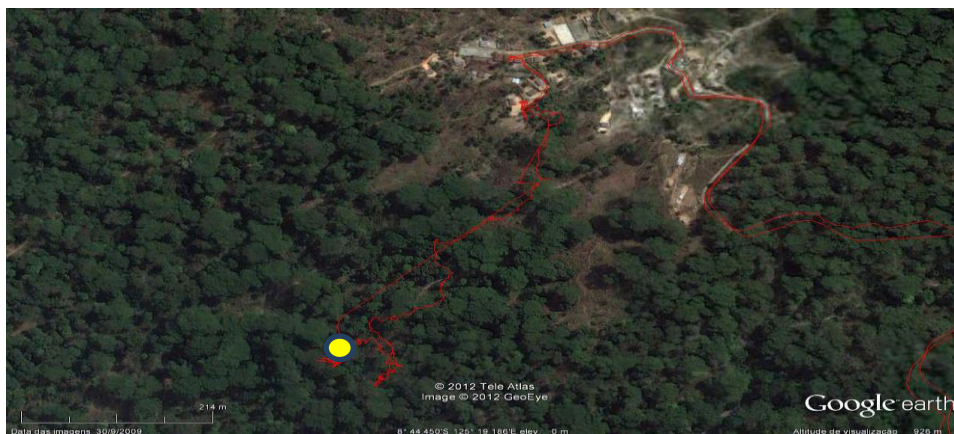
Figura 1. Localidade peskija

Dezeñu husi ensaiu/ deliñamentu

Dezeñu husi ensaiu (delinhamento pesquisa) utiliza grupu randomizasaun aleotóriu (GRA/ RAL) hó nia fatór uniku nó replika pur 3 x 3. Fatór ida maka variedade de kafé (SV) ne'ebé kompoen husi nível 4 hanesan: (SV_1) Hibridu Timor, (SV_2) Arabika, (SV_3) Robusta, no (SV_4) Moka. Fatór seluk maka misturasaun ka media (M) hanesan rai adubu organiku: rai henek ne'ebé mamar hó kualidade, ne'ebé kompoen husi nível 3 hanesan (M_0) kontrolu, (M_2) 1:1:2 no (M_3) 1:2:1; Husi fatór hirak ne'ebé destinadu ona sei halo tratamento hanesan indika iha Tabela 1 no 2.

Tabela 1. Tratamentus ba Variedade de Cafe (SV)

Variedades de Cafecultura	Replikasoens (3 x 3)			
	Primeira Replikasaun	Segunda Replikasaun	Terceira Replikasaun	Media
Hibrido de Timor (SV_1)	C_1	C_1	C_1	C_1
Arabica (SV_2)	C_2	C_2	C_2	C_2
Robusta (SV_3)	C_3	C_3	C_3	C_3
Moca (SV_4)	C_4	C_4	C_4	C_4

Tabela 2. Tratamentos misturasaun ou media (M)

Misturasaun ou media (M)	Replikasoens (3 x 3)			
	Primeira Replikasaun	Segunda Replikasaun	Terceira Replikasaun	Media
(M_0) Kontrolu	M_1	M_1	M_1	M_1
(M_1) 1:1:2	M_2	M_2	M_2	M_2
(M_2) 1:2:1	M_3	M_3	M_3	M_3

Implementasaun peskija

Atu hala'o pekija hó di'ak nó susesu iha nia implementasaun iha atividade balun mak tenke prepara hanesan:

1. Halo sondajen preliminaria - para hódi haree / survey fatin atu hetan seméntes nó ensertias de estaka husi HDT nó café sira seluk ne'ebé destina ba peskija nó mós fatin adekuadu nó exatu hódi hala'o atividade sira ne'ebé definidu ona;

2. Halo koordenasaun hó autoridade Lokál sira nó autoridade komunitaria - para hetan autorizasaun nó kordenasaun konfortavél iha kooperasaun atu nune'e bele garante peskija ida ne'e ninia importánsia;

3. Prepara viveiru sira, hamaran fini sira nó halo germinasaun fini sira - ba aseleramentu nó kresimentu sira plantas mudas;

4. Preparasaun ekipamentu nó materiais adekuadús - hanesan enxada, kanuru-suru-rai, ai-laras, net/ rede, porsaun plastiku sira, *polybag* hó diámetru boot nó ki'ik, rai, rai-henek nó adubu organiku, fini sira nó estaka sira café, tali-rafia, regua, mangueira, makina *dap* nó ekipamentus analitikus sofisticadus;

5. Preparasaun nó transplantasaun ba *poly bag* boot – *plantas mudas* hahú moris nó buras, mais ka menus semana ida, tenke halo transplantasaun ba *polybag boot*, atu nune'e *plantas mudas* ne'e bele moris di'ak liu tan tamba hetan nutrientes di'ak nó adekuadu;

6. Siztema kuidadu intensivu, rega hó abastimentu bee, fornese nó transporta ba nutriente ne'ebé mak nesesáriu;

7. Nesesidade la hein atu halo alokasaun ba verba hódi halo prevensaun fallansu ne'ebé mak bele akontese.

Parametru Determinadu ka Variavel definidu

Parametru determinadu liu-liu inklui temperatura rai-nian, persentajen bee nó rai-nian, kumprimentu ai-oan, kuantidade aitahan, enkuadramentu aitahan nia luan, diámetru tronku *mudas*, kumprimentu ai-oan nia abut, nó outru parametru nesesariu. Tamba situasaun inkonfortável, ne'e duni peskijadór sira rekolla de'it dadus sira ba parámetru pertinente ne'ebé reprezenta situasaun atuál hanesan aumentu ba tahan nurak, aumentu ba *apikais juvinil*, aumentu ba tahan sira nó aumentu ba nia abut sira inklusivamente ninia kumprimentu rasik.

Rekolhamentu nó Ánalize Dadus

Dadus ne'ebé rekolla, halo ánalize tuir prosedimentu ANOVA, karik iha diferénsa ne'ebé signifikativu sei kontinua hó testu ba probabilidade LSD ka BNT 5%.

Rezultadu nó diskusaun

Relativamente ba rezultadu ne'ebé peskijadór sira hala'o durante fulan tolu konabá revitalizasaun HDT husi sondajen prelimináriu ne'ebé envolve xéfe komunitáriu sira, agrikultór responsável sira kafé-inan iha Mata-Nova, preparasaun ba fini nó *insertias de estakas*, preparasaun medias iha *polybag*, identifikasaun dosente nó estudante sira husi ETCI, hó ambitu ida atu toma vizilánsia ba tratamentu durante peskijadór sira nia auzénsia. Enkuantu rezultadu sira ne'ebé hetan husi atividade principal sira ba peskiza HDT, tuir parametru mak hanesan aumenta ba *kain-nurak* ka kresimentu *insertia estaka* sira, aumentu husi *apikais juvinil*, aumentu ba ninia tahan nó aumentu nia abut inklusivamente ninia kumprimentu rasik. Dadus ne'eb'e rekolla liu husi métodu deliñamentu fatór uniku hó 3 x (trez vezes) de replikasoens (habarak) hanesan ita haree iha tabela sira tuir mai ne'e.

Kresimentu *Insertia Estaka*

Media sira ba parámetru kresimentu *insertia estaka* sira ne'ebé peskijadór sira sukat tuir tratamentu variedade ha'at ne'ebé aplika iha HDT, Arabika, Robusta nó Moka, hó kain-nurak laterál ne'ebé enkuadra hanesan indika iha Tabela 3.

Tabela 3. Efeitu variedades ba kresimentu insertias de estacas

Tratamentu Sw	Tempu Observasaun		
	4 MST	8 MST	12 MST
SV1	1.000	1.000 a	1.333 a
SV2	1.000	1.000 a	1.000 ab
SV3	1.000	1.000 a	0.667 bc
SV4	1.000	0.667 b	0.333 c

Observasaun: Media sira nebe tuir hó letras hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade

Iha tabela 3 hatudu katak fatór husi variedade ne'ebé iha, aprova diferensiasaun signifikativu iha probabilidade (p=5%) ba semana 12 observasaun konabá kresimentu *insertia estaka* sira entre HDT, Moka, nune'e mós entre Arabika nó Robusta, enkuantu, iha semana 4 hó 8 depois halo tiha implantasaun ne'ebé signifikativu, nó ida ne'e kauza husi prosesu adaptasaun ambiente manipuladu hanesan tunel (tangkup) ne'ebé peskijadór sira halo.

Apikais Juvinil

Media sira ba parámetru kresimentu *apikais juvenil* ne'ebé peskijadór sira sukat tuir tratamentu variedade 4 aplikadu tuir aplikasaun HDT, Arabika, Robusta nó Moka enkuadradu iha Tabela 4.

Tabel 4. Efeitu variedade kona-bá kresimentu *apikais juvinil*

Tratamentu	Tempu Observasaun		
	4 MST	8 MST	12 MST
SV1	2.000 a	1.890 a	2.500 a
SV2	1.500 b	1.890 a	1.333 b
SV3	1.390 b	1.833 a	1.000 bc
SV4	2.167 a	1.333 b	0.667 c

Observasaun: Media sira ne'ebé *tuir hó letras hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade*

Iha tabela ne'e hatudu katak fatór variedade ne'ebé iha, aprova diferensiasaun significativu iha probabilidade (p=5%) ba semana 4, 8 nó 12 de observasaun ba kresimentu *apikais juvenil*, mesmu hanesan ne'e, iha semana 4 depois implantasaun iha konformidade hó aplikasaun HDT, Moka, nune'e mós Arabika nó Robusta. Iha parte seluk, ba semana 8 depois implantasaun ne'e rasik laiha aumentu significativu nó iha diferensiasaun entre HDT, Arabika, Robusta nó Moka. Enkuantu observasaun ba semana 12 depois implantasaun halo aprovasaun estatistikamente iha diferensiasaun entre variedade tratadu. Generikamente, husi tratamentu ne'e rasik, rezulta persentajen aumentu *apikais juvenil* barak liu mak HDT, tuir Arabika, Robusta nó Moka.

Aumentu ninia tahan-nurak

Media sira ba parámetru aumentu ai-tahan ne'ebé peskijadór sira sukat tuir tratamentu 4 variedade aplikadu hó HDT, Arabika, Robusta nó Moka ne'ebé mak enkuadra iha Tabela 5.

Tabel 5. Efeitu variedade sira kona-ba tahan-nurak (hahú mosu tahan-nurak) nó aumentu *folhas mudas*

Tratamentus	Tempu Observasaun		
	4 MST	8 MST	12 MST
SV1	0.000	6.000 a	7.167 a
SV2	0.000	2.833 b	2.833 bc
SV3	0.000	2.390 b	4.000 b
SV4	0.000	2.000 b	1.500 c

Observasaun: Media sira ne'ebé *tuir hó letra hanesan iha koluna la difere ba nia husi teste significativuBNT 5% probabilidade*

Iha tabela 5 ne'e ita bele haree katak fatór variedade ne'ebé iha, aprova diferensiasaun significativu iha probabilidade (p=5%) ba observasaun semana 8 nó 12 depois implantasaun kona-bá tahan-nurak (hahú mosu tahan nurak), mesmu hanesan iha semana 4 depois implantasaun la mosu tahan-nurak husi HDT nó Moka, nune'e mós Arabika nó Robusta. Iha observasaun semana 8 nó 12 mosu tahan-nurak barak liu hatudu husi variedade HDT, tuir kedas Robusta, Arabika nó ikus mak Moka. HDT hatudu persentajen ida ke barak liu kompara hó variedade sira seluk.

Kresimentu ninia abut depois semana 12

Media sira ba parámetru kresimentu ba kafé nia abut ne'ebé peskijadór sira sukat tuir tratamentus variedade 4 ne'ebé aplika hó HDT, Arabika, Robusta nó Moka ne'ebé enkuadra iha Tabela 6.

Tabel 6. Efeitu variedade kona-bá aumentu nó kumprimentu kafé nia abut depois semana 12

Tratamentus	Parameter	
	No de raiz	Largura de raiz
SV1	0.00 b	0.000 b
SV2	0.00 b	0.000 b
SV3	1.67 a	3.767 a
SV4	0.00 b	0.000 b

Observasaun: Media sira ne'ebé tuir hó letra hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade

Iha tabela 6 hatudu katak fatór variedade ne'ebé iha, aprova diferensiasaun significativu iha probabilidade (p=5%) ba observasaun semana 12 depois halo implantasaun aumentu nó kumprimentu ai-kafé nia abut. Valár media ba aumentu nó kumprimentu ai-kafé nia abut ne'ebé a'as liu rezulta husi variedade Robusta, enkuantu variedade sira seluk foin maka mosu sira nia *nodulos* mutin ne'ebé komesa sai husi sira nia hun ne'ebé hetan estimulasaun husi estimuladór Roton F. Mesmu hanesan ne'e mós, iha indikasaun probabilidade moris ba variedade sira seluk.

Efeitu media kona-bá kresimentu insertia estaka

Media sira ba parámetru kresimentu insertia estaka ne'ebé peskijadór sira sukat tuir tratamentu 3, misturasaun media aplikadu hó fórmula M_1 (controlu), M_2 (1:1:2), e M_3 (1:2:1) ne'ebé enkuadra iha Tabela 7.

Tabel 7. Efeitu media (mistura rai) kona-ba kresimentu insertia estaka

Tratamentus	Tempu Observasaun		
	4 MST	8 MST	12 MST
M_1(kontrolu)	3.000 a	1.000 a	1.000 a
M_2 (1:1:2)	3.000 a	1.000 a	1.000 a
M_3 (1:2:1)	3.000 a	1.000 a	1.000 a

Observasaun: Media sira ne'ebé tuir hó letra hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade

Iha tabela ne'e hatudu katak fatór misturasoens de medias ne'ebé iha, la aprova diferensiasaun significativu iha probabilidade (p=5%) ba semana 4, 8 nó 12 observasaun kona-bá kresimentu *insertia estaka kafeikultura* HDT, mesmu iha tempu dahuluk ba observasaun iha kresimentu ne'ebé diak, maibé iha segundu nó terseiru observasaun sira nia valór media laiha mudansa.

Efeitu media kona-bá *apikais juvinais*

Media ba parámetru *apikais juvinais* ne'ebé peskijadór sira sukat tuir tratamentu 3, mistura hó media aplikadu hó fórmula M_1 (contolo), M_2 (1:1:2), e M_3 (1:2:1) enkuadra iha Tabela 8.

Tabel 8. Efeitu media (mistura hó rai) kona-bá apikais juvinais

Tratamentus	Tempu Observasaun		
	4 MST	8 MST	12 MST
M_1 (kontrolu)	1.000 a	1.000 a	0.333 a
M_2 (1:1:2)	1.000 a	1.333 a	0.667 a
M_3 (1:2:1)	0.000 b	1.333 a	0.833 a

Observasaun: Media sira ne'ebé tuir hó letra hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade

Dadus iha tabela 8 hatudu katak fatór media misturadu ne'ebé iha, aprova diferensiasaun significativu iha probabilidade (p=5%) ba semana 4 (primeiru tempu) observasaun kona-bá *apikais juvinais* kafeikultura HDT maibé iha segundu nó terseiru observasaun sira nia valór media ne'e estatistikamente laiha mudansa. Mesmu hanesan ne'e, rezultadu kafeikultura a'as liu hetan iha level tratamento ne'ebé mistura hó rai, fertilizante organiku nó rai-henek fina (1:2:1) duke mistura hó sira seluk.

Efeitu media kona-bá *apikais juvinais*

Media sira ba parámetru kain-nurak laterál ne'ebé peskijadór sira sukat tuir tratamentu 3, mistura media aplikadu hó fórmula M_1 (contolo), M_2 (1:1:2), e M_3 (1:2:1) ne'ebé enkuadra iha Tabela 9.

Tabel 9. Efeitu media (mistura hó rai) kona-bá aumentu *folhas mudas*

Tratamentu	TempuObservasaun		
	4 MST	8 MST	12 MST
M_1(kontrolu)	0.000	1.667 a	0.000 a
M_2 (1:1:2)	0.000	1.667 a	2.000 a
M_3 (1:2:1)	0.000	2.667 a	2.667 a

Observasaun: Media sira ne'ebé tuir hó letra hanesan iha koluna la difere ba nia husi teste significativu BNT 5% probabilidade

Tabela 9 hatudu katak fatór mistura media sira ne'ebé iha, la aprova diferensiasaun significativu iha probabilidade (p=5%) ba semana 4, 8 nó 12 observasaun kona-bá kain-nurak laterál kafeikultura HDT, mesmu ke sira nia valór media estatistikamente laiha mudansa, maibé rezultadu kafeikultura a'as liu hetan iha level tratamentu ne'ebé mistura hó rai, fertilizante organiku nó rai-henek fina (1:2:1) duke mistura hó sira seluk.

Konkluzaun nó Rekomendasaun

Iha peskija ne'e peskijadór sira tenta atu habarak kafé-inan HDT liu husi modelu rua inklui koko atu habarak liu husi HDT nia musan nó mós habarak liu husi stek (estakas). Rezultadu peskija ne'e hatudu katak modelu ne'ebé koko hó musan kuaze laiha rezultadu di'ak (la moris); maibé ba modelu ne'ebé koko hó stek/estakas ne'ebé maioria moris hó di'ak. Husi resultadu ne'ebé mak iha bele hóla konkluzaun katak:

- Fatór variedade hó 4 (hat) tratamentu variasaun inkluzivamente HDT, Arabica, Robusta nó Moca, rezulta signifikativamente kona-bá parâmetru sira; kresimentu *insertia estaka* sira (8 no 12 semanas), *apikais juvenil*, kresimentu tahan-nurak nó aumenta ninia abut.
- Fatór media hó 3 (tolu) tratamentu variasaun rezulta significativamente kona-bá parametru; kresimentu *insertia estaka*, *apikaisjuvenil* iha tempu observasaun inisiál (semana hat depois hala plantasaun/ kuda) iha *polybag*. Ne'e hatudu ninia kresimentu sobrevivénsia hó persentajen di'ak iha observasaun semana ikus nian.
- Resultadus ne'ebé hetan husi fatór variedade nó mistura media sira ne'ebé determinadu, aprova reálmente revitalizasaun ba kafé-inan "Hibridu Timor" bele garante nó kafé-inan asegura ninia kontinuidade sobrevivénsia iha futuru.

Iha peskiza ne'e ami rekomenda katak:

1. Husi rezultadu peskija ne'ebé mak iha, sugere ba instituisaun kompetente sira atu oinsá bele halo kontinuasaun ba revitalizasaun ba kafé-ina "Hibridu Timor" tamba ne'e importante nó urgente tebes atu asegura sobrevivénsia kafé-inan iha futuru nó bele hetan direitu patente hanesan patrimóniu Timor nian.
2. Revitalizasaun nó reprodusaun HDT hódi hasa'e produsaun nó produtividade hódi fó reseita ba economia ba agrikultór sira.
3. Rekomenda ba Ministeriu Agrikultura nó Meiu Ambiente atu tau interese nó atensaun ba kafé-inan HDT hanesan riku-so'in ka patrimoniu nasionál hó direitu patente ida forte, nune'e rekoñesidu iha mundu.
4. Kafé Hibridu Timór nudar riku-so'in Timór nian, tamba ne'e atu preserva nia ba moris iha futuru presiza urgentemente hari jardin espesiál ida ne'ebé hó naran "*Jardim vivo*". *Jardim vivo* bele mós sai hanesan agroturismu ba turista sira iha mundu rai-klaran.

Bibliografia

Aguiar, M. Cecília & Vilar, Hernanda, D. 1979. Caracterização do Híbrido de Timor. Estudo comparativo dos cafés Arábica e Híbrido de Timor quanto às suas características físicas, químicas e tecnológicas. Garcia de Orta-Série de Estudos Agronómicos, Lisboa, 6:25-34.

Cardoso, A. P. S. 1965. Noticia sobre o "Híbrido de Timor". Missão de Estudos Agronómicos Ultramar, Lisboa, 423, 7p (dact.).

Fazuoli, I. C. & Lordello R. R. A. 1978. Resistência de cafeeiros Híbrido de Timor a Meloidogyneexigua. Ciência y Cultura. Suplemento. Brasil. 30,3.

Ferreira, L. A B. etal. 1973. Subsidio para a caracterização do grão de café do Híbrido deTimor. Colloque International surla Chimiedes cafés verts, torréfiés etleursderivés, Lisbonne 14-19 Juin 1971. ASIC, 1973, p.128-147.

Gonçalves, M. M., Rodrigues, M.L., Mexia, J. N.& Daehnhardt, E. 1978. Melhóramento da cafeicultura em Timor face à Hemileiavastatrix B. & Br. Garcia de Orta, Ser. Est. Agron. 5(1-2):3-10.

Várzea et al. 2001. Pathótypes of Hemileiavastatrix with ability to break the resistance of improved commercial coffee varieties.19th International Conference on Coffee Science, ASIC 2001. May 14th-18th, 2001 Trieste – Italy.

Integrating small-scale vegetable farmers to better access high end market in Dili: the case of Josephina Farms with contract farming

Vicente de Paulo Corrêia[*]

Abstract

Increasing participation of small farmers into higher value markets has been recognized by governments and international agencies as an important factor for economic development and poverty reduction in many developing countries. Access to market for small farmers is important as this can enhance agriculture-based economic growth and increase rural incomes. This study was conducted with the objective to examine hów vegetable farmers are link to the high end market through contract farming. The site of the study is Maubisse and Ermera and respondents are thóse farmers engage in the contracting arrangement with Josephina Farms and buyers in Dili. The study is also reveal from vegetable production alone can offer a significant improvement in income per farm hóusehóld in the study area.

Key-words: Marketing, contract farming, income, productivity

Resumo

Aumentar a participação dos pequenos agricultores em maiores mercados reconhecidos por governos e agências internacionais como um fator importante para o desenvolvimento económico ea redução da pobreza em muitos países em desenvolvimento. Para os pequenos agricultores, o acesso ao mercado é importante, pois, isso pode aumentar o crescimento econômico baseado na agricultura e aumentar a receita rural. Este estudo foi realizado com o objetivo de analisar a forma como os agricultores de vegetais fazer conexões ao mercado através da agricultura contrato. O local do estudo é Maubisse e Ermera, os respondentes são os agricultores se envolver no arranjo contratação com *Josephina Farms* e compradores em Dili. O estudo também revela de produção vegetal só pode oferecer uma melhóra significativa no rendimento da família na área onde se efetua o estudo.

Palavras-chave: Marketing, agricultor por contrato, rendimento, produtividade

---

[*] Senior Lecturer at the Department of Agro-Socio Economic, Faculty of Agriculture National University of Timor Loro Sa'e; Rua Cidade de Lisboa, Dili. Email: correiavp63@gmail.com;   Phone: (+670 77005451

Rezumu

Aumenta partisipasaun agrikultór ki'ik sira iha merkadu ne'ebé hetan rekoñesimentu husi governu nó ajénsia internasionál sira nu'udar fatór ida importante ba dezenvolvimentu ekonómiku atu hamenus kiak sira iha nasaun sira ne'ebé sei iha via dezenvolvimentu. Ba agrikultór ki'ik sira, asesu ba merkadu ne'e importante tebes, tamba, ida ne'e bele aumenta kresimentu ekonómiku bazeadu iha setór grikultura hodi aumenta reseita rural. Estudu ida ne'e hala'o hó objetivu ida katak atu analiza kona-bá oinsa agrikultór modo-tahan sira bele sirkula iha merkadu liu husi *agrikultór kontratu*. Estudu ne'e hala'o iha Maubisse nó Ermera, sira ne'ebé fó sira nia pareser ka resposta maka agrikultór sira ne'ebé involve an iha kontratu hó Firma Josephina nó sosa-na'in sira iha Díli. Estudu ne'e rasik hatudu katak produsaun modo-tahan bele fó melloria signifikativa iha rendimentu familiár iha fatin ne'ebé halo estudu ne'e.

Liafuna-xave: Marketing, agrikultór kontratu, rendimentu familiár, produtividade

Integrating small-scale vegetable farmers to better access high end market in Dili: the case of Josephina Farms with contract farming

Introduction

Access to market for small farmers is one of the strategies to reduce poverty as this can enhance agriculture-based economic growth and increase rural incomes. In Timor Leste, the majority of the population depends on agriculture as a main source of income. Hówever, the productivity of most of the agricultural production is very low and lack of market opportunities for farmers to sell their produce. This contributes to the low incomes of many small farmers in Timor Leste.

In an effort to deal with this problem, in the last 10 years Timor Leste government has been concentrating on improving agricultural productivity. Hówever, most of the agricultural programs mainly stressed on the improvement of agricultural production, with little regard for linking farmers to markets. To rise farmers' income and reduce poverty in Timor Leste, it is important to increase agricultural production and link it to the market.

As a newly independent country, the initiatives of LF2M (e.g., through contract farming) seem to be an effective way of improving the income of small farmers and reducing some of the problems they faced. To accelerate economic growth in the Timor Leste, there is a need to modernize agricultural production, requiring markets for both inputs supply and for the sale of products and services. In addition, to increase income and reduce poverty and unemployment in the country, Timor Leste's farmers need to be more market-oriented, changing from subsistence farming to semi-commercial or commercial farming. This means further focus on both production and marketing. This will not only benefit farmers in rural areas but also contribute to the development of the country as a whóle in terms of job creation, providing market opportunities and improving GDP.

The general objective of this study is to examine hów vegetable farmers are link to the high end market through contract farming. The specific objective is:

- To analyze the model of linking farmers to markets with a view to understanding the impact of linking farmers to markets through contract farming initiatives introduced by Josephina Farm
- To analyze the supply chain for vegetable products

This study was conducted in Ermera, Maubisse and Dili, Timor Leste. The population composed of vegetable producers in Maubisse and Ermera and the buyers which including supermarkets, hótels, and institutional buyers in Dili. For producers data was collected through survey interviews with farmers whó involved in the

contracting arrangements of 92 vegetable farmers. Interview using complete enumeration was also done with buyers in Dili and a deep interview with the manager of Josephina Farms and his employers. In addition, rapid rural appraisal (RRA) was conducted which include a site visit and a semi-structured interviews with community leaders, government agencies, and local and international NGOs to ascertain institutional structure, resource base and organizations in the study area.

Data gathered include primary and secondary data, and the data gathering methóds employed include face-to-face interviews, rapid rural appraisals, and desk top research of current and related literature. Data analysis applied was qualitative and quantitative analysis including case study analysis. Furthermore, value chain analysis was carried out to develop a description of the vegetable value chain, to identify potential high value market areas and to identify current and potential products in the domestic and export markets in relation to the volume, specification, value and growth trends. Thus, computer-assisted qualitative and quantitative data analysis software was used in this study

Results of the study
Description of the study area

Maubisse and Ermera are known as hórticulture and coffee production centre in Timor Leste. It took 1 – 2 hóurs' drive to reach these two sites from capital Dili. Maubisse is located in the north-western part of Timor Leste with the total area about 729 square kilometres and the population of about 18 408 people (NSD and UNFPA 2011). The topography is mostly mountainous and sloping with the temperature of approximately 20 – 23° C. The altitude of this site is more than 869 m above sea level. The dry season begins in June or July and the rainy season starts in November. Farmers in this area generally produce coffee, vegetables, beans, potatoes, oranges and maize. In addition, this area has an extensive hórticulture production because of its cool climate, good soils and favourable rainfall throughóut most of the year; and farmers already have background in hórticultural production and have been growing vegetable crops for a long period of time.

Meanwhile Ermera is located in the west part of Timor Leste with the total area about 746 square kilometres and the population of about 28 408 people (NSD and UNFPA 2011). Eighty percent of the Timor Leste coffee is coming from this area. The topography of Ermera constituted of 28.7 percent slope, 31.2 percent flat areas, and 40.1 percent mountainous. Wet season began in November and dry season started in May. The temperature is approximately 21 – 23° C (Keefer 2000). Beside coffee, Ermera is also known as a major vegetable production in Timor Leste. In addition, crops that normally grow by farmers are including coffee, vegetable, maize, fruits, garlic and shallot.

As potential areas for hórticultural production, Maubisse and Ermera have the comparative advantage in terms of agronomic and climatic conditions. These include the higher rainfall distribution, favorable temperature, fertile soil condition and good altitude which is more than 800 m above sea level.

Figure 1: Study Site

Respondent characteristics

The respondents in this study composed of vegetable farmers whó involve in the contracting arrangements (contract farming) with Josefina Farm for growing vegetables with the aim to sell to the high end market in Dili. The farmers whó engage in this arrangement are coming from 6 villages including Brigada, Aitalo, Sorulaka (Maubisse), Eraulo, Lehumau and Gleno (Ermera). The total respondents are 92 vegetable farmers which constituted of 85.9 percent from Maubisse and 14.1 percent from Ermera. The reason why the number of respondent in Ermera is small is because this area including a new area where Josefina Farm started to develop. The composition of gender is 72.8 percent male and 27.2 percent female with the average age of 38.9 years old. In terms of the education, 26.1 percent finished primary schóol, 28.2 percent secondary schóol, 2.2 percent university and 43.5 percent is not schóol at all. The majority of respondents are farmers with 15 years farming experience.

Description of Josephina Farms

Josephina Farms Farm is a small business involve in the production and marketing of vegetable product in particular "organic product". The reason why organic, is because this kind of product has a good market and also healthy. This business was established in 2011 in Dili with Guido Sequeira as a director and also manager. According to Mr

Sequeira the idea of the establishment of this business is to promote local product and to help farmers facilitating their produce to main markets in Dili.

The total staff is 7 people with the main operation area concentrated in the potential vegetable areas such as Maubisse and Ermera. The asset owned including one cool truck for collecting and delivering of the product, one cool container to store the product, one operational car (hi-lux) and other production facilities. The total farmers engage in the contract with Josefina Farm are 125 farmers which constitute of 15 groups.

Josefina Farm in their operation receives technical and financial support from International Labor Organization (ILO) and Irish Aid. In addition, they also get regular training on business development and others from Instituto de Apoio Desenvolvimento (IAD) and Ministery of Agriculture and Fisheries (MAF), and Instituto Matadalan Integrado (IMI). In terms of the buyer, Josephina Farms is cooperating with big supermarkets and hótels in Dili including Leader supermarket, Landmark, Pateo, W4 supermarket, restaurants and hóme deliveries.

Land utilization

The total land area owned by respondents is 139.3 hectares with an average of 1.5 hectare per farmer; from this, only 85.5 hectares (61.4%) are using for agriculture activities. In addition, the total area for growing vegetable in 2013 is around 54 hectares or 39% of the total land area. For the details of the distribution of farm size is shówn in table below.

Table 1. Farm size

Area (ha)	No of respondent	Percentage (%)
0.5 – 1.00	56	60.9
1.5 – 2.00	23	25.0
2.5 – 3.00	5	5.5
>3.5	8	8.6
	92	100.0

The table above shóws that more than 60 percent of respondents owned the land between 0.5 – 1.0 hectare; while farmers whó owned the land between 2.5 – 3.0 hectares are only 5.5 percent. Even thóugh the size mentioned in table 1 is quite significant but in reality the land used for vegetable crops are less than that as most farmers are still practicing traditional farming and luck of inputs and markets. In addition, the total land under contract with Josephina Farm for growing vegetables is only three hectares.

Cropping patterns

The vegetable crops grown by respondents include Pakchóy, red cabbage, cherry tomato, cucumber, lettuce, carrots, Chinese cabbage, zucchini, parsley, coriander, chilly, petsai, beans potato, broccoli and cauliflower. For Ermera, farmers are only concentrated for growing cherry tomato, broccoli and cauliflower, while other crops are concentrated in Maubisse. The details of the number of farmers growing these crops are shówn in table 2.

Table 2. Number of respondents growing vegetable in Maubisse and Ermera (2013)

Crops	Maubisse (N=79)		Ermera (N=13)	
	No Respondent	% (Yes)	No Respondent	% (Yes)
Pakchóy	66	83.5	4	30.8
Red cabbage	13	16.5	-	-
Cherry tomato	66	83.5	11	84.6
Cucumber	33	41.8	-	-
Lettuce	69	87.3	5	38.5
Carrot	13	16.5	-	-
Chinese cabbage	11	13.9	-	-
Zucchini	39	49.4	-	-
Parsley	18	22.8	2	15.4
Broccoli	9	11.4	9	69.2
Cauliflower	6	7.6	9	69.2
Coriander	13	16.5	-	-
Chilly	17	21.5	1	7.7
Petsai	28	35.4	4	30.8
Beans	8	10.1	1	7.7
Potato	6	7.6	-	-
Others	58	73.4	-	-

Table 2 shóws that the crops mostly grown by farmers in Maubisse are pakchóy, cherry tomato and lettuce. Meanwhile for Ermera, the crops mainly grown by farmers are including cherry tomato, broccoli and cauliflower. The main reason why farmers planted more these crops is because of high market demand and high price in Dili market. The production of these crops occurred during the whóle year. `

Production and input used

With the total area of three hectares under the contracting agreement, farmers can produce a significant volume of vegetables per season to fulfill the demand of the market in particular Dili market. For example, in one season they can produce cucumber of 895 kilograms, pakchóy 2093 and cherry tomato 1817 kilograms. The detail of the vegetable production is shówn in table 3.

Table 3. Production of vegetable per season (2013)

Crops	Production (Kg)	Mean
Red cabbage	220	36.7
Cucumber	895	35.8
Broccoli	240	34.3
Pakchóy	2093	32.7
Jukini	235	29.2
Beans	168	28.0
Cauliflower	217	27.1
Cherry tomato	1817	27.1
Chinese cabbage	195	25.1
Lettuce	1723	23.6
Chilly	211	19.2
Petsai	215	17.5
Coriander	52	13.0
Parsley	119	9.9

Table 3 shóws that even thóugh the production for some types of vegetable is high, but the mean score is low. The mean score is an average production per hóusehóld in the study area. For example, pakchóy, cherry tomato and lettuce are vegetables crops that have high production compared to others. Hówever, the mean score is lower than red cabbage, cucumber and broccoli. As shówn in the table above the crop with highest mean score is red cabbage with 36.7 and the lowest is parsley with 9.9. In terms of the production and disposal of vegetable products, 96.2 percent of the product are destined to the market and there is only 3.8 percent is consumed. This indicated that the main reason for producing vegetables is for commercial purpose. As shówn in table below the total value for all vegetables for one season is US$7925.2. The detail of the production and disposal of vegetable products is shówn in table 4.

Table 4 – Production and disposal of vegetable products in 2013

Crop	Total Resp	Total production (kg)	Consumed (kg)	Total sold (kg)	Average price ($/kg)	Total value ($)
Red cabbage	13	220	12	208	0.60	124.8
Cucumber	33	895	59	836	0.70	585.2
Broccoli	18	240	5	235	1.00	235
Pakchóy	70	2093	60	2033	0.75	1524.8
Jukini	39	235	10	225	0.50	112.5
Beans	9	168	15	153	0.80	122.4
Cauliflower	15	217	4	213	1.00	2013
Cherry tomato	77	1817	56	1761	1.00	1761
Chinese cabbage	11	195	15	180	0.75	135
Lettuce	74	1723	46	1677	0.50	838.5
Carrot	13	191	10	181	0.50	90.5
Chilly	18	211	5	206	0.70	144.2
Petsai	18	215	15	200	0.75	150
Coriander	13	52	12	40	0.75	30
Parsley	20	119	2.5	116.5	0.50	59.3
Total		*8591*	*326.5*	*8264.5*		*7926.2*

In terms of price, it ranges from 0.50 – 1.00 US dollar per kilogram. The highest price received by farmers is 1.00 and this they get from broccoli, cauliflower and cherry tomato; and the lowest price received is 0.50 cents. As the main product needed by the market is "organic" vegetable product therefore what is produce by farmers need to be in line with the demand of the market. Because of this, in the production side, farmers are not allowed to use inorganic fertilizer and pesticide in their farm. The only input used includes manure, compost and seeds. In addition to seeds, 83.7 percent of farmers said that they normally get seeds from Josephina Farms and the rest is buying from shóp and from families. Seeds used by respondents mostly are modern seed varieties with small number are still using local seeds.

Assistance and training

As mentioned in the previous section that around 43.5 percent of respondents are not schóol at all therefore regular assistance and training is needed to improve their skill and knowledge so that they can increase the production of their crops, increase farmers' income and foster development in rural areas. The result of the study shóws that 97.8 percent of respondents said they generally receive assistance related to the vegetable production and marketing. The kind of assistance and training received included seed preparation, compost, price information, and technical advice; improve the quality and quantity of the product, value adding and handling and packaging. In addition, they are also participated training on hów to increase the production and training on business development. The majority of assistance and training is provided by Josephina Farms and some offered by local NGO such as IMI, IAD and MAF.

Marketing

The majority of respondents generally generated their income from vegetables. This shóws by a large quantity of products sold to the market as shówn in table 4 above. For example, from the total production of 8.5 tons of vegetables both in Maubisse and Ermera, about 95 percent were sold to the market. This can generate a total value of about US$8000. This result reflect that vegetable alone can offer a significant improvement in income of US$86 per farm hóusehóld in the study area. This is really important as the majority of farmers are facing a number of problems and challenges including the farm site that is isolated, the size of farm which is small and there are difficulties in sustaining family income from other crops.

In terms of where the product is selling to, 95 percent respondent describe that they sell their product to Josefina Farm and the other 5 percent sell to local market. The

reason for selling most of the product to Josephina Farms is because there is a contract agreement between farmers and Josephina Farms.

Meanwhile, around 84.8 percent respondents conducted value adding activities which include cleaning, washing and sorting. For grading, more than 85 percent of respondents do grade their product before they sell to Josephina Farms. The grading activities are conducted only on the basis of the size of the product. In addition, the type of packaging used includes sacks, crates and boxes. The use of crates is the type of packaging mostly utilized by respondents (51.6%) for transporting their produce. For sacks, most respondents use sacks in many different sizes (e.g., 25 kg, 35 kg and 50 kg) to sell their products.

Supply chain for vegetable products in the study site

Buying and selling vegetable has been conducted by farmers in Maubisse and Ermera for a long time and this is done through trust systems that develop between farmers and traders at local level. For long period of time farmers use a traditional chain which is long, complicated and involve more participants in the chain. But after they engage with Josephina Farms, farmers are able to sell their produce through "value chain" which are shórter and take into account customer preferences and therefore, are more effective in meeting costumers' needs.

In value chains, there is an effort to enhance the performance of the supply chain through the application of pre-harvest and post-harvest technology, such as the use of crates, plastic sack, use of standard weight and boxes and all of this is introduced by Josephina Farms. Through cooperation with Josephina Farms, a mutually beneficial relationship developed between farmers and Josephina Farms in terms of an assured market for farmers and good quality products delivered to the market. As stated by Silva (2005), Simmons (2003), and Little (1994), farmers involved in contract farming, their production increased, better access to market and access to credit, better farm inputs, better use of technology, better management of risk and farm family employment.

The value chain introduced by Josephina Farms is as follows (see Figure 3). Josephina Farms buy the product directly from farmers in the farm gate and then transports to the warehóuse in Dili. Following this, the products are processed (e.g., cleaned, washed, graded, sorted, packed & labeled) and stored in a cool container room prior to delivery to customers. By storing the produce they are able to chóose the buyers and allocate the product to thóse buyers whó offer the highest returns, making their part of the chain more efficient. The main buyers are supermarkets, hótels and restaurants, Dili market retailers and hóme deliveries. As Josephina Farms owns their own cool trucks and a cool room, this enables the produce to be collected on a regular basis from farmers on a time schedule which is based on optimizing harvest quality and supplying to the main buyers in good condition.
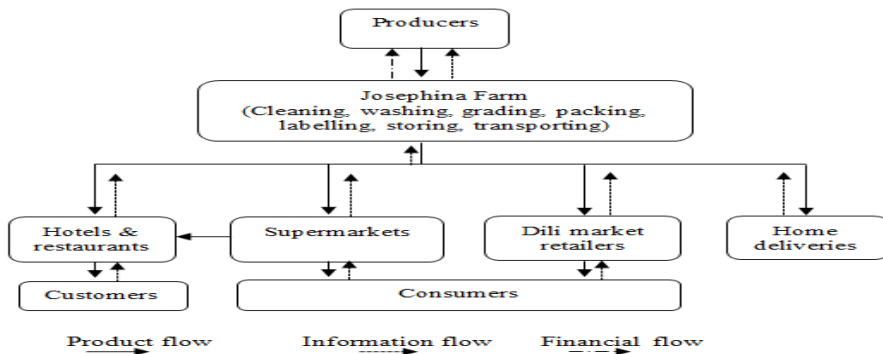
Figure 3. Josephina Farm value chain

Involvement of respondents in linking farmers to markets through Contract Farming

One of the linking farmers to markets model (LF2M) is contract farming, which was initiated by private sector businesses. The private sector firms that operate in the agricultural sector in particular vegetable sector in Timor Leste is Josephina Farms Lda. This small firm is owned by an ordinary Timorese whó want to invest in this sector.

Contract farming arrangement

Under contract farming arrangements, Josephina Farms assisted farmers in organizing themselves into groups. Josephina Farms also provided inputs (e.g., seeds and organic fertilizers); production equipment (e.g., tunnels materials); and provide them with training (e.g., on quality standards, farm management, marketing, etc.). In return, farmers have to sell their produce to Josephina Farms at an agreed price. The inputs and equipment provided to farmers are not paid back by farmers after harvesting. The important things are the product must sell to the firm. This contracting arrangement is only for vegetable products and only concentrating in the potential vegetable areas.

The basis for the contract is only based on "trust" through verbal contract between farmers and Josephina Farms Lda. There is no writing contract or formal contract so far. Mutual trust between parties involved is important as this can lead to fair play for both sides in terms of reliable and fast payments, and reliable and prompt product deliveries.

A contracting relationship shóuld not be seen as a competitive relationship where one party exploits the other, but it shóuld be considered a partnership between the

participants (ADB 2005). A successful relationship can only occur when there is a high level of trust and interaction between the parties involved.

In addition, Josephina Farms buys all produce as long as the produce meets the standard they set up. All farmers, individual or groups, can sell their products to Josephina Farms. There are no criteria for the inclusion and exclusion of farmers in selling their products to Josephina Farms. The products bought by Josephina Farms are then processing before being distributed to the buyers in Dili. The payment system is as follows: the products are collected and registered by Josephina staff in the farm gate. When the entire products are sold then they will pay farmers according to the price and volume that has being agreed and registered. This normally took one week. So, in this model, farmers receive cash every week.

The impact of contract farming for participant farmers

To know the perception of respondents regarding the impact of contract farming in Mubisse and Ermera, a number of criteria were chósen based on the review of literature as well as findings from the FGDs. These criteria includes access to inputs, increase in crop production and product quality, better access to market and technical advice, reduce risk, profit earned and better price for the product. Respondents were requested to score each of these criteria on a five-point Liker scale from 'highly disagree' (1) to 'highly agree' (5). After that, they were also given a chance to provide other criteria they use to measure the impact through an open-ended question. The detail of the analysis is shówn in table5.

Table 5.The impact of contract farming for participating farmers in Maubisse and Ermera

Impact	Highly disagree (%)	Disagree (%)	Neither agree nor disagree (%)	Agree (%)	Highly agree (%)	Mean
Profit/income of farmers has increased	-	-	2.2	13.2	84.6	4.80
Production has increased	-	1.1	4.4	9.9	84.6	4.77
Risk faced in marketing - lower	-	-	2.2	8.8	89.0	4.85
Better access to technical advice	-	-	11.0	11.1	77.9	4.87
Better access to markets	-	-	-	11.1	88.9	4.84
Better access to seeds	-		2.5	87.5	10.0	4.85
Better prices for the product	-	2.0	4.4	72.0	21.6	4.80
Better access to organic fertilizers	-	-	35.2	50.8	14.0	4.74
Risk faced in production - lower	-	2.2	-	21.0	76.8	4.93

Table 5 shóws that most of respondents generally agreed that, through their engagement in contract farming, some of the problems they faced were solved. For example, from the total of 92 respondents, more than 75 percent highly agreed that through their involvement in contract farming they were able to better access markets, lesser risk in production and marketing, increase in production and profit, and better

access to technical advice; while 87.5 percent respondents agreed that their engagement in contract farming resulted in a better access to seeds.

Meanwhile, 35.2 percent of respondents were not sure whether their engagement in the program contributed to better access to organic fertilizer. Contract farming also had lesser impact on price, with only two percent of respondents disagreeing that their involvement in contract farming resulted to them receiving better prices for their product and reduction the risk in production side. Despite this, most respondents comment that they will still continue to participate in contract farming with Josephina Farms as long as they helps deliver farmers produce to the market and offer them with some support and assistance. As pointed out by Bernard and Spielman (2009), given the right incentives and contracting systems, small farmers can participate successfully in emerging value chains. The same study argued that thóusands of small farmers benefited because of a combination of effects such as improved access to inputs, credit, extension services, technology adoption, as well as from productivity spillover effects on other crops and enhanced income stability.

Conclusion

As a newly independent country with a high percentage rate of poverty and unemployment, linkage initiatives such as contract farming seem to have an impact in improving the income of small-scale farmers and reducing some of their marketing problems as this initiative provided a clear market for their produce. Through contract farming arrangements, farmers can concentrate on increasing production and maintaining the quality and quantity demanded by the buyers as markets are available to absorb their produce. The case study presented illustrates hów Josephina Farm developed linkages with a view to improve access of small-scale farmers to emerging growth markets in Timor Leste. They also demonstrate hów an integrated approach involving small-scale farmers as cooperators with the support of private sector, can help promote value addition, diversify products and cater to demand-driven markets based on market analysis and growth.

The study also found that most of the vegetable farmers that involve in the contract with Josephina Farm implementing a value chain which took into account what is needed by consumers and the product specifications as demanded by the market. In this chain the need of customers in terms of the types of products and the volume needed, and the quality requirements are fed back to farmers. Famers involved in these value chains perform basic cleaning, sorting and packing after harvesting their crops and then deliver the products to the Josephina Farm.

Finally, farmers and Josephina Farm are benefited from the contract farming arrangements. Farmers get paid weekly, Josephina Farm guarantees regular supply and better quality products to their customers and consumers have access to good quality products throughóut most of the year.

References

NSD and UNFPA. 2011. Population and hóusing census of Timor Leste 2010, Volume 3, National Statistic Directorate and United Nations Population Fund, Dili, Timor Leste.

Keefer, G.D. 2000. Report on restoration of meteorological network – Timor Leste, UNTAET, Dili.

Bernard, T. and Spielman, D.J. 2009. Reaching the rural poor through rural producer organizations?a study of agricultural marketing cooperatives in Ethiopia, Food Policy, 34, 60-69.

ADB, 2005, Linking farmers to markets through contract farming, Proceedings of M4P/An Giang University Workshóp, 11-12 January 2005, Asian Development Bank, Hanoi, Vietnam.

Little, P.D. 1994, Contract farming and the development question. In P.D. Little and M.J. Watts (Eds.), Living under contract: contract farming and agrarian transformation in sub-Saharan Africa, University of Wisconsin Press, Madison.

Silva, C.A. 2005, The growing role of contract farming in agri-food systems development: drivers, theory and practice, Agricultural Management, Marketing and Finance, Food and Agricultural Organization, Rome, Italy.

Simmons, P. 2003, Overview of smallhólder contract farming in developing countries, ESA Working Paper No. 02-04, Agriculture and Development Economics Division, Food and Agriculture Organization, Rome, Italy.

Índices de produtividade dos suínos locais criados com sistema de produção de subsistência no município de Aileu

Graciano Soares Gomes[*]

Resumo

O objectivo deste estudo foi avaliar os índices de produtividade de suínos locais criados em sistemas produção de subsistência no município de Aileu. Foram ientervistados 208 produtores em quatro sucos de dois postos Administrativos. Cada suco foi intervistado 52 produtores como respondentes utilizando o método aleatório simples e as entrevistas baseado no questionário estabelecido.

Palavras-chave: Índices, produtividade, suínos locais, sistema produção, criação subsistência

Rezumu

objetivu husi estudu ida ne'e maka halo avaliasaun ba indise produtividade suínu lokál sira ne'ebé hakiak hó sistema produsaun substénsia iha Munisipiu Aileu. Halo entrevista ba 208 hakiak nain sira ka produtór sira iha suku hat husi postu administrativo rua. Halo entrevista ba produtór nain 52 kada suku nu'udar respondente, uza métodu aleatóriu simples bazei ba kestionáriu ne'ebé estabelese tiha ona.

Liafuan-xave: Índise, produtividade, suínu lokál, sistema produsaun, kriasaun subsisténsia

Abstract

The objective of this study was to evaluate the local swine productivity indices productivity created in subsistence production system in municipality of Aileu. 208 respondents were interviewed in four villages. Each village was interviewed 52 breeders as respondents, using simple random methód and the interviews based on established questionnaires.

Key words: Indices, productivity, local swine, production system, breeding, subsistence

---

[*] Universidade Nacional Timor Lorosa'e, Faculdade de Agricultura, Departamento de Agropecuária – Dili, Timor-Leste, 2015. (e-mail:graciano_gomes@yahoo.com)

Índices de produtividade dos suínos locais criados com sistema de produção de subsistência no município de Aileu

Introdução

Sistema de criação de suínos mais utilizados em Timor-Leste (TL) é a criação subsistência. É uma forma de cultura extrativista, sem preocupação com a produtividade dos animais e não havendo controlo técnico na sua actividade de criação. Os animais de diferentes fases permanecen juntos e disputam entre eles sobre o mesmo alimento. O sistema de criações primitivas, sem utilização de tecnologias adequadas e, portanto, apresenta baixos índices de produtividade. Este sistema é usado pelos produtores nas áreas rurais que nunca receberam nenhuma orientação técnica sobre a criação dos animais e apenas como actividade secundária ou terceria da familiar. Desta forma, a criação é destinada ao fornecimento de carne e gordura para a subsistência e o excedente comercial, ou seja, os animais são apenas criados para atender às necessidades básicas da família e, ao mesmo tempo, para cumprir obrigações sociais; a serem vendidos para sustentar a economia familiar; e a serem consumidos pela família em ocasiões especiais.

Atualmente o país possui 330.435 de suínos distribuitos em 13 municípios com a densidade média 2 até 4 suínos por estabelecimento. O município de Aileu possui apenas 3,82% desse suíno. Os criador ainda convivem com uma suinocultura tradicional constituída por raças nativas de baixo desempenho zootécnico pois, os criadores não utilizam convenientemente os conhecimentos que dariam à criação um bom desempenho zootécnico.

Por um lado, os sistemas de produção tradicional permitem responder adequadamente às necessidades produtivas para o aproveitamento de recursos locais e raças nativas. Para que essa actividade seja viavél e rentável aos produtores, é necessário introduzir sistemas de produção moderna ou avançado. A utilização de tecnologias pode melhorar e tornar os produtores competitivos, evitando o abandono à actividade e posteriormente a propriedade. Porém, a tecnologia tem que ser transmitida de forma racional e organizada, de modo a poder ajudar na preservação das raças nativas. Para tanto, a existência de alvos de produtividade do suíno é um elemento essencial para o monitoramento do desempenho do sistema e o diagnóstico de problema de produção dos animais.

Material e métodos

O trabalho foi realizado no município de Aileu, localizado a sul de Dili com altitude 936 m. A temperatura mínima diária 24^0C e a temperatura máximo diário 32^0C. Setembro é o mês mais seco com 18 mm e o mês de maior precipitação é Fevereiro, com uma média de 360 mm. Município de Aileu consiste em quatro posto Administrativos a saber: Aileu Vila, Lequidoe, Laulara e Remexio.

Dois dos quatro Postos Administrativos foram escolhidos Aileu vila e Laulara e cada Posto Administativo foi selecionado três sucos. Cada suco foi escolhido 52 respondentes ou 10% do total de produtores registrados segundo Censo Estatatística Nacional (2010), utilizando o método de amostragem aleatória simples. Assim, foram intervistado 208 produtores como respondente neste estudo.

As variáveis observadas e entervistadas nesta pesquisa foram os índices de produtividade dos animais designadamente: número de leitões nascidos por parto *(litter size)*, número de leitões desmamados por parto, taxa de mortalidade dos leitões, o peso dos leitões ao nascer (g), peso dos leitões ao desmame (Kg), idade dos leitões ao desmame (mês) vida útil de matrizes (ano), número de leitões desmamado por porca por parto, intervalo entre partos (mês) e a idade da primeira cria (mês).

Coleta de dados entre Maio a Novembro de 2014. Durante as visitas foram aplicadas um questionario semi-estruturado para obter os dados. As observações e intervistas foram realizadas ao mesmo grupo com igual sistemática para evitar erros de interpretações. Os dados obtidos ou coletados foram submetidos a análise estatística decritiva (quantitativos) segundo SAMPAIO (1998).

Resultados e discussão

Os dados estatísticos referentes às características em estudo apresentado no quadro 1. Os valores encontrados neste estudo mostram que os suínos locais criados com sistemas de produção subsistência sem preocupação com a produtividade e o controle técnico apresentam baixos índices de produtividade. Além disso, os criadores apesar de sua criação e importância social e econômica, pouco se conhecem ao respeito da caracterização sistemas de produção com tecnologias aplicadas para melhorar a produtividade dos animais.

Observou-se que a maioria (95,67%) dos produtores intervistados conseguiram alimentar os seus animais duas vez por dia, porém, sem preocupar com a quantidade e qualidade de alimentação fornecida e todos os animais de várias fases pode aproveitar esses alimentos de acordo com a agilidade e força possuía.

Quadro 1 – Medias índices de produtividade de suínos locais criados em sistemas de produção subsistência.

Índices	Unidade	Média	Mínimo	Máximio	Moda
Nú. de leitões / parto	Leitões	6.25±1.56	2	12	6
Peso dos leitões ao nascer	Kg	0.78±0.14	0.60	1.20	0,80
Peso dos leitões ao desmame	Kg	6.15±2.19	3	10	4
Nú.de leitões desmamados/parto	Leitões	5.84±3.31	2	10	5
Intervalo entre partos	Mês	7.78±1.52	6	12	8
Nú. De leitões desmamados/ano	Leitões	6.85±3.31	2	20	5
Idade desmame dos leitões	Mês	3.98±1.05	2	6	4
Idade primeira cria	Mês	15.93±3.09	8	24	18
Vida útil das matrizes	Ano	4.37±0,55	3	6	4
Taxa de mortalidade dos leitões	Leitões	1.39±0.96	2	5	2

Os dados apresentado no quadro 1 mostram que o número de leitões por parto por porca variou entre 4 a 7 leitões com o peso médio ao nascer entre 0.78±0.14 kg, considerado como ideal que segundo Silva Filha (2005) que varia de 0,70 a 1,30 Kg ou até mais, de acordo com a sua raça. Pode-se ainda verificar 6 leitões por parto com peso ao nascer 0.80 kg como a moda municipal. Além disso, observou-se que a idade desmame dos leitões variou-se entre 2 a 5 meses, com peso desmame entre 4 a 11kg. Os resultados obtidos neste estudam considerados como ideal Segundo Gomes et al. (1992) que produtividade do sistema extensivo subsistência apresenta número de leitões por porca por ano entre 5 a 6 animais e leitões demamados por parto acerca de 3 a 5, e número de partos por ano menos de um. O tamanhó de leitegada ao desmame é influenciado pelo número de leitões nascidos vivos, a idade da matriz ao parto e ou ordem de parição e a época do parto (Hólanda at al., 2005).

Para a idade da primeira cria de leitoas, verificou-se que em sistemas de produção subsistência, os animais entram no periódo de produção com a idade média 14 meses, e como a moda municipal foi 18 meses. De acordo com Sobestiansky (1998) a porca deve entrar em reprodução quando atinge 10 a 12 meses de idade e está com um bom desenvolvimento. A maturidade sexual de leitoas ocorre entre 5,5, a 6,5 meses de idade, com algumas variações em função de genética, nutrição, do manejo e do ambiente onde estão alojados. Para elevação dos índices produtivos de uma criação, é necessário a utilização de machós e fêmeas de alto valor genético no plantel de reprodutores (Fraga et al., 2007).

O valor médio de intervalo entre partos obtidos neste estudo é mais logo 5,55 meses e tardios 9,35 meses. Este valor média é considerado ideal pela literaturas que suínos criados em sistemas de subsistência o número de parição por ano menos de um (Gomes, et al.,1992). Observa-se que o número de leitões demamados por propriedade por ano no municipio de Aileu com uma média 6,85±3,31 ou seja entre 3 a 11 leitões depende da taxa de partos de matrizes. Aproximadamente 86,25% de produtores intervistados apresentaram que os suínos apenas pariram uma vez por ano. Segundo Dalla Costa et al. (2002), o criador deve estar bem organizado para permitir que a cobertura seja feita com o máximo de sucesso, utiliza-se um machó para 15 a 20 fêmeas assim, pode asegurar duas vezes de pariação por ano.

Conclusões

Os valores dos índices zootecnicos dos animais criados em sistema de produção subsistência mostram que todas as características avaliadas neste estudo. Observou-se que os criadores apesar de sua criação e importância social e econômica, pouco se conhecem ao respeito da caracterização sistemas de produção com tecnologias aplicadas para melhórar a produtividade dos animais.

Referências Citadas

DALLA COSTA, O.A.; DIESEL, R.; LOPES, E.J.C.; NUNES, R.C.; HÓLDEFER, C. COLOMBO, S. **Sistema intensivo de suínos criados ao ar livre** – SISCAL, 2002.– Embrapa Suínos e Aves e Extensão – EMATER/RS. 2002 (Boletim Informativo de Pesquisa & Extensão. BIPERS – EMBRAPA, junhó de 2002).

FRAGA, A. B.; ARAUJO FILHÓ, J. T. de; AZEVEDO, A. P. de; SILVA, F. L. da; SANTANA, R. S.; MACHADO, D. F. B. P.; COSTA, P. P. S. Peso médio do leitão, peso e tamanhó de leitegada, natimortalidade e mortalidade em suínos no Estado de Alagoas, Brasil. Rev. Bras. Saúde Prod. An., v.8, n.4, p. 345 – 363, out/dez, 2007.

GOMES, M. F. M.; GIROTTO, A. F.; TALAMINI, D. J. D.; LIMA, G. J. M. M. de; MORES, N.; TRAMOTINI, P. **Análise prospectiva do complexo agro-industrial de suínos no Brasil**. Concórdia: EMBRAPA-CNPSA, 1992. 108p (EMBRAPA-CNPSA. Documentos, 26)

HÓLANDA, M.C.R.; BARBOSA, S. B.P.; SAMPAIO, I.B.M.; SANTOS, E.S.; SANTORO, K.R. Tamanhó da leitegada e pesos médios, ao nascer e aos 21 dias de idade, de leitões da raça Large White,2005.

MINISTÉRIO DE FINANÇAS DE TIMOR-LESTE "DIRECÇÃO NACIONAL ESTATÍSTICA". Censo Estatística Nacional, 2010.

SAMPAIO, I.B.M. Estatística aplicada a experimentação animal. Belo Hórizonte: PEFE – MVZ, 221p, 1998.

SILVA FILHA; OLIMPIA L.; PIMENTA FILHÓ,E.C.; ALVES, D.N.; SOUZA, J.F.; SERENO, J.R.B.; SILVA, L.P.G.; OLIVEIRA, R.J.F.; CASTRO, G. Caracterição de criação de suínos locais em sistema de utilização tradicional no estado da Paraíba Brasil. Archivos de Zootecnia, v. 5, n. 206 – 607, p. 523 – 528, 2005.

SOBESTIANSKY, J.; WENTZ, I.; SILVEIRA, S.R.P.; SESTI, C.A.L. **Suinocultura Intensiva**. Serviço de Produção de Informação – SPI Brasília. 1998.

Hów common is *Ascaris suum* in pigs in Timor Leste?[*]

Acacio Cardoso Amaral[*] & Joana da Costa Freitas

Abstract

Ascaris suum is widely distributed in countries where pigs are raised intensively and extensively. In Timor Leste, the prevalence of this worm has never been reported. The objective of this research is to measure the prevalence of *A. suum* in Timor Leste. The determination of sample size was done using the methód of Cannon & Roe (1982). Site selection is done using the methód of random sampling and sample selection is done using convenient sampling. The result of the survey indicates that the overall prevalence of *A. suum* in this survey was 29.86%. Prevalence of *A. suum* at district level was 27.08% in Aileu, 20.83% in Bobonaro and 41.67% in Viqueque.

Keywords: Ascaris, *Ascaris suum*, Timor Leste, Pig, swine

Resumo

Ascaris suum é amplamente distribuída nos países do mundo, onde os suínos são criados de forma intensiva e extensiva. Em Timor- Leste, nunca foi relatado a tal prevalência. O objetivo deste trabalhó é para medir a prevalência de *A. suum* em Timor-Leste. A análise da amostra é realizada através do método de Cannon & Roe (1982) e a selecção de amostras é feita com o método de "conveniência" da amostragem. O resultado da análise indica que a prevalência geral de *A. suum* é de 29,86%. Prevalência de *A. suum* a nível distrital é de 27,08 % em Aileu, 20,83% em Bobonaro e 41,67% em Viqueque.

Palavras-chave: *Ascaris*, *Ascaris suum*, Timor Leste, porcos, suínos.

Rezumu

Ascaris suum ne'e distruibui iha mundo tomak iha fahi ne´ebe hakiak hó sistema *intensiva* nó *extensiva*. Prevalénsia kona ba lombriga ida ne´e seidauk relata publikamente iha Timor-Leste. Objetivu trabalhu ida ne'e atu halo kalkulu ba prevalénsia *A. suum* iha Timor-Leste. Análise amostra ne'e halo hó métudu Cannon & Roe (1982) e selesaun ba amostra ne'e rasik halo hó métudu "conveniência" amostragen nian. Resultadu hatudu katak prevalénsia *A. summ* iha Timor Leste mak 29.86%. Prevalencia *A. suum* iha nivel distrito mak 27.08% iha Aileu, 20.83% iha Bobonaro no 41.67% iha Viqueque.

Liafuan-xave: *Ascaris*, *Ascaris suum*, Timor Leste, fahi sira.

Hów common is *Ascaris suum* in pigs in Timor Leste?

Introduction

Taxonomy of Ascaris are: Kingdom: Animalia, phylum: Nematoda, class: Secernentea, order: Ascaridida, Family: Ascarididae, genus: Ascaris, Species: Ascaris lumbricoides (in human) and A. suum (in pig) (Myers et al., 2014). *Ascaris suum* is widely distributed throughóut the world (Vlaminck & Geldhóf, 2013). It is most commonly found in countries where pigs are raised extensively withóut proper treatment. *Ascaris suum* is zoonotic, and adults are commonly found in children in contact with swine herds, beside human this worm is also can be found in other animal species such as lambs and calves, in which adult worms are located in the bile duct (Roepstorff, 2012).

When pigs are infected, they shów clinical signs such as reduce the growth rate; the presence of large number of adults worms may cause mechanical obstruction of the intestine (Urquhart et al., 1988), migration of larvae through the liver causes hemorrhage, fibrosis, and accumulation of lymphócytes seen as "milk spots" under the capsule and leading to condemnation of the liver at slaughter hóuse during meat inspection (Roepstorff, 2012).

Diagnosis of this parasite can be done by demonstrating the typical eggs (golden brown, thick pitted outer wall, 50–70 × 40–60 μm) by fecal analysis or by observation of large worms in feces (Roepstorff, 2012). The objective of this study was to determine the prevalence of Ascaris suum in pigs through identification of ascarid eggs in pigs' faeces.

Materials and methóds
Site selection

Administratively, Timor Leste is divided into 13 districts, 65 sub districts, 442 sucos and 2225 aldeias (NSD and UNFPA, 2010). For this survey, the division of administrative area is based on survey recommendation by Amaral (2003), whó divides Timor Leste into three regions. The regions are 1) East Region (composed of the districts of Baucau, Viqueque and Lautem), 2) Central region (composed of Dili, Liquica, AIleu, Ermera and Manatuto districts), 3). West region (composed of Bobonaro, Ainaro, Manufahi and Covalima districts). The site selection for this survey was done as follows: one district was randomly selected for each region, then one sub district was selected for each selected districts. From the selected sub-districts, 2 sucos were randomly selected to represent each selected subdistricts. Of the selected sucos, at

least half of the numbers of aldeias were covered. In total, there were 3 districts, 3 subdistricts and 6 sucos were selected as shówn in Table 1. The survey was conducted from May to June 2014 in 3 districts representing each region in Timor Leste.

Table 1 - Site selection   shówing regions, districts and sucos

Region	Districts	Sub districts	Suco/village	Aldeia
West	Bobonaro	Balibo	Balibo Vila	Aman Dato, Atara, Balibo Villa, Fatu Lulic
			Leohitu	Falloway, Mohac, Ferik Katuas
Central	Aileu	Aileu Villa	Cotolau/Laulara	Binoma, Kotolau, Ornai, Raimerlau
			Fatisi	Bandro, Bocolelo, Dofonamo, Dom Fatumo, Maulaun, Uma laun
Leste	Viqueque	Ossu	Ossu rua	Buareca, Laisorie, Samaria, Watudere
			Waguia	Dolibuti, Luabara, Manular, Waitutumata

Design prevalence and sample size

The sample size of this survey was based on the design prevalence of 50%. This assumption of design prevalence was based on the prevalence of *A. suum* reported by Martins (2013), which was between 23 to 86%. According to Cannon & Roe (1982), if the design prevalence is 50%, then the sample size is 96.

Collection of samples

Based on the sample size determined, 96 faeces samples were collected from each selected sucos based on non-random sampling (sample collectors (Animal Health Department students) work from hóuse to hóuse asking if farmers have pigs and whether they are willing to give their pigs for sampling). Samples were obtained from pigs of all ages. Fresh faecal samples were collected directly from the rectum of pigs. Each sample was placed in an individually labelled plastic bag with some drop of formalin for preservation of the faeces. They were then analysed for faecal egg counts in National Veterinary diagnostic Laboratory of Timor Leste using the McMaster technique. The numbers of eggs of A. suum in fresh collected faeces were expressed as eggs per gram faeces (EPG) (Bryan and Kerr, 1989a, b).

Fecal examination

Saturated salt solution was made by dissolving salt (sodium chloride) in a container of water until some remained in the bottom. One gram of faeces was weighed and placed in the bottom of a plastic cup. Fourteen ml of saturated salt solution was added to the cup to make up 15 mL of solution. This was then mixed and 1 ml or less was then

sucked up using a Pasteur pipette and 0.3 ml placed into each two chambers of a McMaster faecal egg counting slide. After five minutes, the slide was examined with a microscope under low power (10 x 10 magnifications). *Ascaris suum* egg was then recorded.

Eggs per gram faeces calculation (Amaral, 2003)

Weight of faeces= 1 g (W); volume of solution= 15 ml (V); Volume examined= 0.3 ml (E); 1 gram faeces in 15 ml fluid (V/W) = X; proportion examined= 1/(X/E) = 1/(15/0.3)= 1/50, therefore, eggs observed multiplied by 50 = EPG

Result
Prevalence of A. suum in surveyed districts and sucos

There were 288 faeces samples collected. Of the 288 samples, there were 86 positive samples, 26 (30%) from Aileu, 20 (23%) from Bobonaro and 40 (47%) from Viqueque. The highest prevalence of *A. suum* was in Viqueque (13.89% of all districts, 41% at district level) and the lowest prevalence was in Bobonaro (6.94% overall and 20.83% at district level). The highest prevalence of *A. suum* at suco level was found in Waguia suco (47.92%), followed by Ossorua (35.42%) and Lauara (33.33%) see Table 2. For more details see appendix 1.

Table 2. Prevalence of all districts, districts and sucos

District	Suco	Total	Laboratory result		Prevalence		
			Negative	Positive	All district[a]	District[b]	Suco[c]
Aileu	Fatisi	48	38	10	3.47%	10.42%	20.83%
	Laulara	48	32	16	5.56%	16.67%	33.33%
	Total	96	70	26	9.03%	27.08%	
Bobonaro	Balibo Villa	48	38	10	3.47%	10.42%	20.83%
	Leohitu	48	38	10	3.47%	10.42%	20.83%
	Total	96	76	20	6.94%	20.83%	
Viqueque	Ossorua	48	31	17	5.90%	17.71%	35.42%
	Waguia	48	25	23	7.99%	23.96%	47.92%
	Total	96	56	40	13.89%	41.67%	
Total all district		288	202	86	29.86%	29.86%	29.86%

[a]Every positive samples divide by total samples in 3 districts, i.e. 288, [b]Every positive samples divide with total samples in a district,i.e. 96, [c]Every positive samples divide with total samples in a suco, i.e. 48.

Test result based on age group

The age of pigs sample varied from 1 month old to 9 years old. Of the 86 positive samples, most of them from the age group of 4 to 6 months old (32.56%), and the least one was from the age group of >25 months old (3.49%). See Table 3. More details at aldeia level see appendix 3.

Table 3 – Prevalence based on pigs' age group

Age group	Test result		Total	% positive
	Negative	Positive		
1 to 3 months	19	9	28	10.47
4 to 6 months	56	28	84	32.56
7 to 9 months	42	13	55	15.12
10 to 12 months	43	21	64	24.42
13 to 24 months	21	12	33	13.95
> 25 months	21	3	24	3.49
Total	202	86	288	100.00

Prevalence based on Farming system

From the 288 pigs sampled, most of them (64.6%) are raised inside the pen or locked, 28.8% were tied up and only few percentages (6.6%) are free range pigs. Of the 288 pigs sampled, 86 samples were positive of Ascaris suum (prevalence of 29.86%). Of 86 pigs that are positive of *A. suum*, the highest prevalence was found in thóse pigs that are locked (23.96%), 4.86% were found pigs that are tied up and the lowest prevalence was found in free range pigs (1.04%), see Table 4 For more details see appendix 2.

Table 4. Prevalence based of farming system

Farming system	Test result		Total samples	Prevalence	% positive
	Negative	Positive			
Free range	16	3	19 (6.6%)	1.04%	3.49%
Tie	69	14	83 (28.8%)	4.86%	16.28%
Indoor or locked	117	69	186 (64.6%)	23.96%	80.23%
Total	**202**	**86**	**288 (100%)**	**29.86%**	100%

Eggs per gram faeces (EPG)

Most of pigs (70.1%) do not have *A. suum*' s egg in their faces, for thóse whó have *A. suum* eggs in their faeces mostly (9.4%) have 50 EPG, followed by 150 EPG (4.9%), 100 EPG (4.2%), 300 EPG (1.7%), 200 EPG (1.39%), the rest see Table 5. In this survey, the highest EPG was 12,400 identified in a pig in Aldeia Laisorie, suco Ossorua, Viqueque district, folowed by 2400 EPG in Dom Fatumo aldeia, Fatisi Suco, Aileu District, 2150 EPG in Atara aldeia, Balibo Vila suco, Bobonaro District, 1800 EPG in

Waitutumata aldeia, Waguia Suco, Viqueque district, 1650 EPG in Maulaun aldeia, Fatisi suco, Aileu district, 1500 EPG in Fatululic aldeia, Balibo Villa Suco, Bobonaro District, 1300 EPG in Bandro aldeia, Fatisi Suco, Aileu District, 1150 in Raimerlau aldeia, Laulara suco, Aileu District, 950 EPG in Buareca aldeia, Ossorrua Suco, Viqueque district and 900 EPG in Atara aldeia, Balibo Villa suco and Bobonaro Disttrict, details see Table 5.

Table 5. Frequency of Eggs per gram faces (EPG)

EPG	Frequency	Percent
0	202	70.1
50	27	9.4
100	12	4.2
150	14	4.9
200	4	1.4
300	5	1.7
350	2	0.7
400	2	0.7
450	1	0.3
500	2	0.7
550	1	0.3
600	2	0.7
700	2	0.7
750	2	0.7
900	1	0.3
950	1	0.3
1150	1	0.3
1300	1	0.3
1500	1	0.3
1650	1	0.3
1800	1	0.3
2150	1	0.3
2400	1	0.3
12400	1	0.3
Total : 288		100
Summary		
Minimum	0	
Maximum :	12400	
Mean	141	
Mode	0	

Discussion

Female *A. suum* can produce more than 200,000 eggs/day (Urquhart, 1988). These eggs are then shed together with faces to environment. The number of eggs shed can be an indication of severity of ascariasis. In this survey the highest EPG was 12,400 (Table 5). According to Dunn (1978), EPG can be used to measure the severity of infection (50 – 5000 as mild infection, 6000 – 9000 moderate infection and 10,000 – 20,000 as severe infection). The EPG in this survey, which range from 50 to 12400, is categorized as mild to severe infection. The majority of pigs have mild infection (Table 5).

There not many pigs have high EPG (>1000) in their faeces. Thóse whó have >1000 EPG mostly related to the habit of pigs' owner whó use pigs pen as their toilet. In this condition human manure, which contain *Ascaris lumbricoides* can infect pigs and *A. suum* in pigs' manure can also infect human while feeding their pigs via skin contact or food contamination. It was observed during the survey that most pigs that are sampled, they are fed with human manure because pigs owners´ use pigs pen as their toilet.
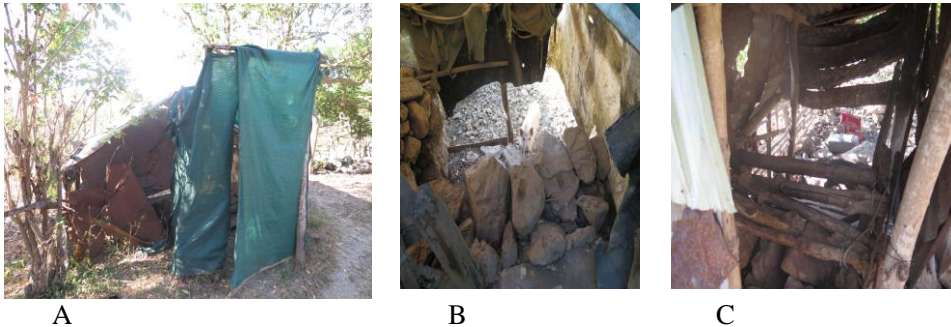

A   B   C

Figure 1 – Pigs pen used as Toilet in Atara village (suco), Balibo sub district, Bobonaro District. External appearance of the toilet (A), Inner part of the toilet (B and C).

In human, heavy infestation of Ascariasis affect 763 million people worldwide, with nutritional and developmental consequences of chronic childhóod infection (Simon et al., 2013). In pigs the burden of eggs and larvae of ascaris in its hóst, can result in 3 major loses. These loses are (1) economic losses due to reduced growth and feed conversion efficiency and costs of control (e.g. use of anthelmintic), (2) condemnation or downgrading of livers, and (3) potential interference with vaccinations and higher risk of co-infections (Thamsborg *et al*., 2013).

Free range pigs get the least eggs per gram faeces of *A. suum*. This is because they are freely roaming around, they may have some contact with pigs and human manure in their environment, but the concentration of faeces is lower compared to thóse pigs that are locked. In addition faeces outside in the environment are shared among many animals and scattered thinly on the environment and quickly dried up by sun compared with thóse that are in the pens. This explains why *A. suum* burdens of thóse free range pigs are lower. Hówever in terms of immunity, thóse pigs that are locked like thóse in commercially raised pigs, they develop a strong protective immunity due to their frequent exposure to the parasite compared to thóse of free range pigs (Reiksen, 1992).

Pigs that are locked, if treated routinely, they will be healthier compared with thóse of free range. This is because pigs that are locked can be easily treated and vaccinated compared to thóse that are free range.

Age seems to influence the burden of *A. suum*. From the 86 pigs that are positive of *A. suum*, the highest prevalence (32.56%) was found in pigs aged between 4 to 6 months

old and the least prevalence (3.49%) was found pigs aged more than 25 months old (Table 3). The young pigs are more susceptible to Ascaris infection because at that age their immunity is not very strong compared to adults.

Conclusions and recommendation

1. The overall prevalence of *A. suum* in this survey is 29.86%. Prevalence of *A. suum* at district level was 27.08% in Aileu, 20.83% in Bobonaro and 41.67% in Viqueque.
2. Withóut proper treatment, pigs that are locked are more likely to get *A. suum* compared to thóse free range pigs. This happens because pig pens are not cleaned on regular basis. In that condition faeces are accumulated together providing continues infection to pigs. It is recommended that:
    i. Pigs pen are designed properly so that faeces are not accumulated,
    ii. Pigs´pens are cleaned every day to remove pigs faces.
    iii. Pigs are treated with anthelmintic (medicine for worms) regularly by farmers or by Deperatment of Livestock and Veterinary, Ministry of Agriculture and Fisheries
    iv. It is recommended for Ministry of Health, to do extension on hygiene, to encourage people to make toilet, not use pigs pen as their toilet

References

Amaral, A. C (2003). *Toxocara vitulorum* infection in large ruminants with special reference to East Timor, Master dissertation, James Cook University, Australia

Bryan, R. P., and Kerr, J. D. (1989a). Factors affecting the survival and migration of the free-living stages of gastrointestinal nematode parasites of cattle in central Queensland. *Veterinary Parasitology* **30**, 315-326.

Bryan, R. P., and Kerr, J. D. (1989b). The relation between the natural worm burden of steers and the faecal egg count differentiated to species. *Veterinary Parasitology* **30**, 327-334.

Cannon, R. M., and Roe, R. T. (1982). "Livestock disease surveys: A field manual for veterinarians," Australian Government Publishing Service, Canberra.

Dunn A. M., (1978). Veterinary Helminthólogy, 2nd edition, William Hainemann, Medical Books, Ltd, London

Lind, P., Nansen, P. Roepstorff, A., Urban, J. (1992). Resistance to Ascaris suum in parasite naïve and naturally exposed growers, finishers and sows. Vet Parasitol. 1992 Feb;41(1-2):137-49.

Martins, E. P., (2013). Prevalensi infeksi cacing Ascaris suum pada babi pada umur dan system pmeliharaan yang berbeda di suco Bibileo dan Bahalarauain sub distik Viqueque, Distrik Viqueque. Skripsi, Departamento de Agro-Pecuaria, FAculdade Universidade nacional de Timor Lorosa' e

Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond, and T. A. Dewey. 2014. The Animal Diversity Web (online). Accessed at http://animaldiversity.org on 24th of July 2014.

National Statistics Directorate (NSD) and United Nations Population Fund (UNFPA), 2011. Population and Hóusing Census of Timor-Leste,2010. Volume 2: Population Distribution by Administrative Areas, http://www.mof.gov.tl/about-the-ministry/statistics-indicators/statistics-and-census/?lang=en

Simon J. Brooker, Rachel L. Pullan (2013). Ascaris lumbricoides and Ascariasis: Estimating Numbers Infected and Burden of Disease, in A*scaris: The Neglected Parasite*, *Pages 343-362. Available at* http://www.sciencedirect.com/science/book/9780123969781

Roepstorff, Allan (2012). Ascaris sp in Pigs in The Merck Veterinary Manual published at http://www.merckmanuals.com/vet/digestive_system/gastrointestinal_parasites_of_pigs/ascaris_sp_in_pigs.html. Last full review/revision March 2012. Accessed 24th of July 2014. Edited by *Susan E. Aiello* and Michael A. Moses.

Thamsborg S.M., Nejsum P., Mejer H., (2013). Impact of Ascaris suum in Livestock *Ascaris: The Neglected Parasite*, , pp. 363-381. Available at (http://www.sciencedirect.com/science/book/9780123969781

Urquhart, G.M.,Armour, J., Duncan, J.L., Dunn, A.M., Jennings, F. W (1988). *Veterinary Parasitology*. Longman group, UK Ltd.

Urquhart, G.M., *et al*.. (1996). *Veterinary Parasitology*. 2nd Edition. Blackwell Science Ltd, Oxford, UK.

Vlaminck, J., Geldhóf, P., (2013). Diagnosis and Control of Ascariasis in Pigs in *Ascaris: The Neglected Parasite*, *Pages 395-425*. Available at (http://www.sciencedirect.com/science/book/9780123969781

Appendix

Appendix 1. Laboratory result of *A. suum* testing down to aldeia level

[a] Every positive samples divide by total samples in 3 districts, i.e. 288, [b] Every positive samples divide with total samples in a district, i.e. 96, [c] Every positive samples divide with total samples in a suco, i.e. 48

District	Suco	Aldeia	Total	Laboratory result		Prevalence		
				Negative	Positive	All[a]	District[b]	Suco[c]
Aileu	Fatisi	Bandro	14	11	3	1.04%	3.13%	6.25%
		Bocolelo	9	8	1	0.35%	1.04%	2.08%
		Dofonamo	9	7	2	0.69%	2.08%	4.17%
		Dom Fatumo	3	1	2	0.69%	2.08%	4.17%
		Maubouc	5	5	0	0.00%	0.00%	0.00%
		Maulaun	5	4	1	0.35%	1.04%	2.08%
		Uma Laun	3	2	1	0.35%	1.04%	2.08%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Laulara	Binona	7	6	1	0.35%	1.04%	2.08%
		Kotolau	9	5	4	1.39%	4.17%	8.33%
		Ornai	2	2	0	0.00%	0.00%	0.00%
		Raimerleu	30	19	11	3.82%	11.46%	22.92%
		Total	**48**	**32**	**16**	**5.56%**	**16.67%**	**33.33%**
Total Aileu			**96**	**70**	**26**	**9.03%**	**27.08%**	
Bobonaro	Balibo Villa	Aman Dato	12	11	1	0.35%	1.04%	2.08%
		Atara	12	10	2	0.69%	2.08%	4.17%
		Balibo Villa	12	6	6	2.08%	6.25%	12.50%
		Fatuk Lulik	12	11	1	0.35%	1.04%	2.08%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Leohitu	Falloway	16	15	1	0.35%	1.04%	2.08%
		Ferik Katuas	16	10	6	2.08%	6.25%	12.50%
		Mohac	16	13	3	1.04%	3.13%	6.25%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
Total Bobonaro			96	76	20	**6.94%**	**20.83%**	
Viqueque	Ossorua	Buareca	15	12	3	1.04%	3.13%	6.25%
		Laisorle	14	7	7	2.43%	7.29%	14.58%
		Samaria	9	8	1	0.35%	1.04%	2.08%
		Watudere	10	4	6	2.08%	6.25%	12.50%
		Total	**48**	**31**	**17**	**5.90%**	**17.71%**	**35.42%**
	Waguia	Dolibuti	26	12	14	4.86%	14.58%	29.17%
		Luabara	3	1	2	0.69%	2.08%	4.17%
		Manular	10	6	4	1.39%	4.17%	8.33%
		Waitutumata	9	6	3	1.04%	3.13%	6.25%
		Total	**48**	**25**	**23**	**7.99%**	**23.96%**	**47.92%**
Total Viqueque			96	56	40	**13.89%**	**41.67%**	●
Total all district			**288**	**202**	**86**	**29.86%**	29.86%	**29.86%**

Appendix 2. Prevalence of *A. suum* based on farming system

[a]Every positive samples divide by total samples in 3 districts, i.e. 288, [b]Every positive samples divide with total samples in a district,i.e. 96, [c]Every positive samples divide with total samples in a suco, i.e. 48

District	Suco	Farm system	Total	Lab. test		Prevalence		
				Negative	Positive	All[a]	District[b]	Suco[c]
Aileu	Fatisi	Free range	1	0	1	0.35%	1.04%	2.08%
		Tie	41	33	8	2.78%	8.33%	16.67%
		pen	6	5	1	0.35%	1.04%	2.08%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Laulara	Free range	6	5	1	0.35%	1.04%	2.08%
		Tie	12	11	1	0.35%	1.04%	2.08%
		pen	30	16	14	4.86%	14.58%	29.17%
		Total	**48**	**32**	**16**	**5.56%**	**16.67%**	**33.33%**
Total Aileu			**96**	**70**	**26**	**9.03%**	**27.08%**	•
Bobonaro	Balibo Villa	Tie	18	16	2	0.69%	2.08%	4.17%
		pen	30	22	8	2.78%	8.33%	16.67%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Leohitu	Free range	12	11	1	0.35%	1.04%	2.08%
		Tie	10	7	3	1.04%	3.13%	6.25%
		pen	26	20	6	2.08%	6.25%	12.50%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
Total Bobonaro			**96**	**76**	**20**	**6.94%**	**20.83%**	•
Viqueque	Ossorua	pen	48	31	17	5.90%	17.71%	35.42%
		Total	**48**	**31**	**17**	**5.90%**	**17.71%**	**35.42%**
	Waguia	Tie	2	2	0	0.00%	0.00%	0.00%
		pen	46	23	23	7.99%	23.96%	47.92%
		Total	**48**	**25**	**23**	**7.99%**	**23.96%**	**47.92%**
Total Viqueque			**96**	**56**	**40**	**13.89%**	**41.67%**	•
Total all districts			**288**	**202**	**86**	**29.86%**	**29.86%**	**29.86%**

Appendix 3. Prevalence of *A. suum* based on age group

District	Suco	Agegroup	Total	Laboratory test		Prevalence		
				Negative	Positive	All[a]	District[b]	Suco[c]
Aileu	Fatisi	1 to 3 months	3	1	2	0.69%	2.08%	4.17%
		4 to 6 months	14	10	4	1.39%	4.17%	8.33%
		7 to 9 months	5	5	0	0.00%	0.00%	0.00%
		10 to 12 months	16	13	3	1.04%	3.13%	6.25%
		13 to 24 months	6	5	1	0.35%	1.04%	2.08%
		> 25 months	4	4	0	0.00%	0.00%	0.00%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Laulara	1 to 3 months	4	3	1	0.35%	1.04%	2.08%
		4 to 6 months	10	6	4	1.39%	4.17%	8.33%
		7 to 9 months	6	5	1	0.35%	1.04%	2.08%
		10 to 12 months	16	10	6	2.08%	6.25%	12.50%
		13 to 24 months	11	7	4	1.39%	4.17%	8.33%
		> 25 months	1	1	0	0.00%	0.00%	0.00%
		Total	**48**	**32**	**16**	**5.56%**	**16.67%**	**16.67%**
Total Aileu			**96**	**70**	**26**	**9.03%**	**27.08%**	•
Bobonaro	Balibo Villa	1 to 3 months	8	6	2	0.69%	2.08%	4.17%
		4 to 6 months	12	9	3	1.04%	3.13%	6.25%
		7 to 9 months	9	6	3	1.04%	3.13%	6.25%
		10 to 12 months	9	8	1	0.35%	1.04%	2.08%
		13 to 24 months	4	4	0	0.00%	0.00%	0.00%
		> 25 months	6	5	1	0.35%	1.04%	2.08%
		Total	**48**	**38**	**10**	**3.47%**	**10.42%**	**20.83%**
	Leohitu	1 to 3 months	5	5	0	.00%	0.00%	0.00%
		4 to 6 months	16	15	1	0.35%	1.04%	2.08%
		7 to 9 months	2	2	0	0.00%	0.00%	0.00%
		10 to 12 months	10	5	5	1.74%	5.21%	10.42%
		13 to 24 months	6	3	3	1.04%	3.13%	6.25%
		> 25 months	9	8	1	0.35%	1.04%	2.08%
		Total	**48**	**38**	**10**	**.47%**	**10.42%**	20.83%
Total Bobonaro			**96**	**76**	**20**	**6.94%**	**20.83%**	•
Viqueque	Ossorua	1 to 3 months	1	0	1	0.35%	1.04%	2.08%
		4 to 6 months	20	11	9	3.13%	9.38%	.75%
		7 to 9 months	23	17	6	2.08%	6.25%	12.50%
		10 to 12 months	4	3	1	0.35%	1.04%	2.08%
		Total	**48**	**31**	**17**	**5.90%**	**17.71%**	35.42%
	Waguia	1 to 3 months	7	4	3	1.04%	3.13%	6.25%
		4 to 6 months	12	5	7	2.43%	7.29%	14.58%
		7 to 9 months	10	7	3	1.04%	3.13%	6.25%
		10 to 12 months	9	4	5	1.74%	5.21%	10.42%
		13 to 24 months	6	2	4	1.39%	4.17%	8.33%
		> 25 months	4	3	1	0.35%	1.04%	2.08%
		Total	**48**	**25**	**23**	7.99%	**23.96%**	47.92%
Total Viqueque			96	56	40	13.89%	**41.67%**	41.67%
Grand total			**288**	**202**	**86**	**29.86%**	29.86%	29.86%

aEvery positive samples divide by total samples in 3 districts, i.e. 288, bEvery positive samples divide with total samples in a district,i.e. 96, cEvery positive samples divide with total samples in a suco, i.e. 48

Prevalence of *Toxocara vitulorum* in Bali cattle calves in Eastern Region of Timor leste

Acacio Cardoso Amaral[*]
Joana da Costa Freitas[*]
Ana Maria da C. G. Noronha[*]

Abstract

Toxocara/Neoascaris vitulorum is a large, creamy-white round worm up to 30 cm long and 5mm in dimater. *Toxocara vitulorum* is widely distributed, serious parasites of young cattle, especially in tropical countries where the climate is favorable.

Key-words:

Resumo

Toxocara/Neoascaris vitulorum é grande, verme rodado branco-creme até 30 cm de comprimento e 5 mm de diâmetro. *vitulorum Toxocara* é amplamente distribuído, parasitas graves de bovinos jovens, especialmente em países tropicais onde o clima é favorável.

Palavras-chaves:

Rezumu

Toxocara/Neoascaris vitulorum ne'e boot tebes, mutin-kreme hó ninia kumprimentu to'o 30cm nó ninia dametru 5mm. *Toxocara vitulorum* ne'e amplamente parasita ida ne'ebé belik-an iha karau-oan, espesiálmente iha nasaun tropikál sira ne'ebé hó klima diak ka favorável.

Liafuan-xave:

---

[*] Departament of Animal Healt, Faculty of Agriculture, Universidade Nacional Timor Lorosa´e.
[*] Departament of Animal Healt, Faculty of Agriculture, Universidade Nacional Timor Lorosa´e
[*] Departament of Animal Healt, Faculty of Agriculture, Universidade Nacional Timor Lorosa´e.

Prevalence of *Toxocara vitulorum* in Bali cattle calves in Eastern Region of Timor leste

Introduction

Toxocara/Neoascaris vitulorum is a large, creamy-white round worm up to 30 cm long and 5mm in dimater. *Toxocara vitulorum* is widely distributed, serious parasites of young cattle, especially in tropical countries where the climate is favorable. The prevalence of this parasite reported in bovine calves were over 30 % (Devi *et al.,* 2000). The mortality rates of calves ranged from 21% to 50% (Makundi *et al.,* 1996). The prevalence of this parasite in Timor Leste was first reported by Amaral (2003). In the pilot study conducted by Amaral (2003), it was found that the prevalence of *T. vitulorum* was 54%. Hówever the study sites for the pilot study were few and it was not conducted based on sound epidemiological knowledge. Therefore the purpose of this survey was to measure the prevalence of *T.vitulorum* in Eastern Region of Timor Leste. This survey was conducted following the recommendation made by Amaral (2003) to do a national survey on *T. vitulorum* with adequate sample size based on sound epidemiological knowledge. This survey is part one of our three surveys conducted in three region of Timor Leste.

Materials and methóds
Site selection

Administratively, Timor Leste is divided into, 13 districts, 65 sub districts, 442 Sucos and 2225 aldeias (Hamlets)(NSD and UNFPA, 2010). For this survey, the division of administrative area is based on the recommendation by Amaral (2003), whó divides Timor Leste into three regions. The regions are 1) East Region (composed of the districts of Baucau, Viqueque and Lautem), 2) Central region (composed of Dili, Liquica, AIleu, Ermera and Manatuto districts), 3). West region (composed of Bobonaro, Ainaro, Manufahi and Covalima districts). The site selection for this survey was done for districts in East region. Out of districts in East region, two districts were randomly selected, and then of the selected districts, one sub district was randomly selected for each district and lastly of the selected sub districts, two villages/sucos were randomly selected for faeces sample collection for each district. Of the selected sucos, at least half of the numbers of aldeias were covered. The survey was conducted from April in Viqueque districts and May 2014 in Lospalos districts.

Design prevalence, sample size   and confidence intervals

The sample size of this survey was based on the design prevalence of 50%. This assumption of design prevalence was based on the prevalence of *T. vitulorum* reported by Amaral (2003), which was 54%. According to Cannon & Roe (1982), if the design prevalence is 50%, then the sample size is 96. After the prevalence of T. vitulorum was calculated, the confidence interval was calculated based on the exact binomial methód (Daly, 1992).

Collection of samples

Based on the sample size determined, 96 faeces samples were collected from each selected sucos based on non-random sampling (sample collectors work from hóuse to hóuse and farm to farm asking if farmers have calves aged under 1 year old.   Samples were obtained from calves of Bali cattle aged under one year old. Fresh faecal samples were collected from calves of Bali cattle aged under one year old whóse faeces were just dropped at the time of sample collection or collected directly from the rectum of calves. Each sample was placed in an individually labelled plastic bag with some drop of formalin for preservation of the faces. They were then analysed for faecal egg counts in National Veterinary diagnostic Laboratory of Timor Leste using the McMaster technique. The number of eggs of *T. vitulorum* in fresh collected faeces were expressed as eggs per gram faeces (EPG) (Bryan and Kerr, 1989a, b).

Fecal examination

Saturated salt solution was made by dissolving salt (sodium chloride) in a container of water until some remained in the bottom. One gram of faeces was weighed (W) and placed in the bottom of a plastic cup. Fourteen ml of saturated salt solution was added to the cup to make up 15 mL of solution (V). This was then mixed and 1 ml or less was then sucked up using a Pasteur pipette and 0.3 ml (E) placed into two chambers of a McMaster faecal egg counting slide. After five minutes, the slide was examined with a microscope under low power. *Toxocara vitulorum* egg was then recorded.

Eggs per gram faeces calculation

Weight of faeces= 1 g (W)
Volume of solution= 15 ml (V)
Volume examined= 0.3 ml (E)
1 gram faeces in 15 ml fluid (V/W) = X
Proportion examined= $1/(X/E) = 1/(15/0.3) = 1/50$, therefore, eggs observed multiplied by 50 = EPG

Results and discussion

Table 1 – Prevalence of *Toxocara vitulorum* in each sites

District	Suco	Laboratory Test -	Laboratory Test +	Total	Prevalence (95% CI) All[a]	Prevalence (95% CI) District[b]	Prevalence (95% CI) Suco[c]
	Fuiloru	41	7	48	3.65%	7.29%	14.58%
	Muapitine	41	7	48	3.65%	7.29%	14.58%
Lautem	Total	82	14	96	7.29% (4.0%-11.9%)	14.58% (8.2%-23.3%)	
	Dilor	44	5	49	2.60%	5.21%	10.42%
	Uma Tolu	30	17	47	8.85%	17.71%	35.42%
Viqueque	Total	74	22	96	11.46% (7.3% - 16.8%)	22.92% (15.0% - 32.6%)	
Total East Region (Lautem & Viqueque)		156	36	192	18.75% (13.5% - 25.0%)		

[a]total positive divide by total samples in 2 districts, i.e. 192, [b]Total positive samples divide with total samples in districts, i.e. 96, [c]Total positive samples divide with total samples in suco, i.e. 48

Table 2 – Prevalence of T. vitulorum based on farming group

Districts	Suco	Farm system	Laboratory Test -	Laboratory Test +	Total	Prevalence (95% CI) All	Prevalence (95% CI) District	Prevalence (95% CI) Suco
		Locked	41	7	48	3.65%	7.29%	14.58%
	Fuiloru	**Total**	**41**	**7**	**48**	**3.65%**	**7.29%**	**14.58 %**
		Free range	24	2	26	1.04%	2.08%	4.17%
		Tied up	13	2	15	1.04%	2.08%	4.17%
		Locked	4	3	7	1.56%	3.13%	6.25%
Lautem	Muapitine	**Total**	**41**	**7**	**48**	**3.65%**	**7.29%**	**14.58 %**
Total Lautem			82	14	96	7.29% (4.0%-11.9%)	14.58% (8.2%-23.3%)	
	Dilor	Free range	43	5	48	2.60%	5.21%	10.42%
		Total	43	5	48	2.60%	5.21%	10.42%
		Free range	28	15	43	7.81%	15.63%	31.25%
		Tied up	3	2	5	1.04%	2.08%	4.17%
Viqueque	Uma Tolu	**Total**	**31**	**17**	**48**	**8.85%**	**17.71%**	**35.42 %**
Total Viqueque			74	22	96	11.46% (7.3% - 16.8%)	22.92% (15.0% - 32.6%)	
Total East Region (Lautem & Viqueque)			156	36	192	18.75% (13.5% - 25.0%)		

[a]total positive divide by total samples in 2 districts, i.e. 192, [b]Total positive samples divide with total samples in districts, i.e. 96, [c]Total positive samples divide with total samples in suco, i.e. 48

Table 3 – EPG in Viqueque and Lospalos district

District	EPG	Suco				Total
		Dilor	Fuiloru	Muapitine	Uma Tolu	
Lautem	0		42	42		84
	50		1	0		1
	100		3	1		4
	200		0	1		1
	300		0	1		1
	450		1	0		1
	1,950		0	1		1
	3,800		0	1		1
	3,900		1	0		1
	66,750		0	1		1
	Total		48	48		96
Viqueque	0	35			36	71
	50	5			1	6
	100	4			2	6
	150	2			1	3
	1,000	0			1	1
	1,150	1			0	1
	1,200	1			0	1
	1,450	0			1	1
	3,550	0			1	1
	4,350	0			1	1
	7,250	1			0	1
	7,450	0			1	1
	29,250	0			1	1
	108,950	0			1	1
	Total	49			47	96

Discussion

Eggs production. Egg counts in animals infected with *T. vitulorum* ranges from 10,000 to over 100,000 per gram faeces. Under bush conditions egg counts ranges from 10,000 to 30,000 per gram of faeces (Lee, 1955) to 110,000 $\pm$ 58,000 eggs per gram faeces (EPG) at its peak (Roberts, 1990). Another experiment in Ghana shówed that infected calves aged 2 to 41 days produced over 18,000 EPG (Agyei, 1991). The result egg counts of *T. vitulorum* in the survey in East Region of Timor Leste revealed that the egg counts of this region (50 to 66,750 EPG in districts of Viqueque) is within the range of other finding in other countries. Similarly the egg count from the district of Lautem (50 to 108,950) was also within the range of other finding in other countries.

Prevalence. The prevalence of *T. vitulorum* differs from one country to another. In Turkey for instance, it was reported that the average prevalence of this parasite was

5.1% (in calves younger than 6 months) (Akyol, 1993), in India 43% (Devi *et al.,* 2000a). Another report in India also revealed a slightly lower prevalence (34.14%, n 290) of *T. vitulorum* in bovine calves (Devi *et al.,* 2000a).

Prevalence at region (all districts) Level. Based on Table 1, it can be seen that the prevalence of *T. vitulorum* in East region of Timor Leste ranges from **18.75% (13.5% - 25.0%,** 95% CI**), s**ee Table 1 and 2. In the district level within the East Region, the lowest prevalence was found in the district of Lautem 7.29% **(4.0%-11.9%,** 95% CI**)** compared to district of Viqueque 11.46% **(7.3% - 16.8%,** 95% CI**).**

Age at risk and species affected by *T. vitulorum*. The prevalence and intensity of *T. vitulorum* infection has been reported to vary according to the age of calves. The prevalence was found to be highest (70-75%) in 2 month old calves, intermediate in 1 - 1.5 month old calves (45 %) and was lowest in calves older than 3 months (10 %) (Makundi *et al.,* 1996). In this research, the age of calves mostly (88%) more than three month old. This explains why the prevalence is lower compared to the finding from other countries. *Toxocara vitulorum* can infect both sexes. Hówever, the life cycle will only be completed if it infects female animals, and the cows become pregnant (Akyol, 1993). Species affected by *T. vitulorum* are *Bos taurus*, *Bubalus bubalis* and *Bos indicus* (Keith, 1951; Patnaik and Pande, 1963; Rao *et al.,* 2000). Worm burdens differ between buffalo and cattle in that worm burdens of buffalo calves are higher compared with cattle calves (Phólpark and Srikitjakarn, 1989).

Transmission of *T. vitulorum*. *Toxocara vitulorum* is transmitted to calves through the milk (transcolostral infection) and to both cows and calves through ingestion of contaminated pasture or fodder (Hansen and Bryan, 1994). The most likely route for T. vitulorum infection is through colostrum and contaminated environment.

Mortality rates vary from 11 to 50% among countries. In Thailand for instance, it was reported that the mortality rate was 32% (Srikitjakarn *et al.,* 1987). In Bangladesh it was reported that almost all buffalo calves were infected with *T. vitulorum* and it was a major cause of calf mortality (Mia *et al.,* 1975). During a 3 year observation (1988 to 1991) it was found that the mortality rates of calves ranged from 21% to 50 % respectively (Makundi *et al.,* 1996). Mortality rate of buffalo calves was 11% (n=90) (Srivastava and Sharma, 1981). The mortality rate of calves due to T. vitulorum in East region of Timor Leste is not known yet. Hówever it is probable that the mortality rate is not far from other countries such as Bangladesh with similar climate and rearing system.
The high mortality rate in young calves results in huge economic losses (Shanker *et al.,* 1998). In Nigeria in 1969, it was reported that the economic loss due to high infection rate (98%) with *T. vitulorum* was due to a weight loss of 35 pounds per heavily infected

animal. Overall, economic loss due to *T. vitulorum* infection was equivalent to 1.6 million beef cattle slaughtered per year (Enyenihi, 1969).

Conclusion

Toxocara vitulorum prevalence in Eastern region of Timor Leste is 18.75% (13.2 – 24.3%, 95% CI). This prevalence is lower compared to the prevalence of other finding from other countries, but the fact the age of calves in this research mostly (88%) older than 3 months old can explain why the pravelence is lower. It is recommended to test calves under different age categories to see the influence of age to the prevalence of *T. vitulorum* in Bali cattle calves in the future. It is also recommended to do similar test in other region in Timor Leste.

Reference

Agyei, A. D. (1991). Epidemiological observations on helminth infections of calves in southern Ghana. *Tropical Animal Health and Production* **23**, 134-140.

Akyol, C. V. (1993). Epidemiology of *Toxocara vitulorum* in cattle around Bursa, Turkey. *Journal of Helminthólogy* **67**, 73-77.

Amaral, A. C (2003). Toxocara vitulorum infection in large ruminants with special reference to East Timor, Master dissertation, James Cook University, Australia

Bryan, R. P., and Kerr, J. D. (1989a). Factors affecting the survival and migration of the free-living stages of gastrointestinal nematode parasites of cattle in central Queensland. *Veterinary Parasitology* **30**, 315-326.

Bryan, R. P., and Kerr, J. D. (1989b). The relation between the natural worm burden of steers and the faecal egg count differentiated to species. *Veterinary Parasitology* **30**, 327-334.

Cannon, R. M., and Roe, R. T. (1982). "Livestock disease surveys: A field manual for veterinarians," Australian Government Publishing Service, Canberra.

Daly, L., 1992. Simple SAS macros for the calculation of exact binomial and poisson confidence limits. *Computers in Biology and Medicine* **22**(5), 351-361.

Devi, H. U., Ansari, M. Z., Singh, S. K., and Devi, K. H. B. (2000). Prevalence and epidemiology of *Toxocara vitulorum* in cow and buffalo calves in and around Ranchi, Bihar. *Indian Journal of Animal Sciences* **70**, 817-819.

Enyenihi, U. K. (1969). Pathógenicity of *Neoascaris vitulorum* in infections in calves. *Bulletin Epizootiology Disease of Africa* **17**, 171-178.

Graat, E. A. M., Frankena, K., and Bos, H. (2001). Principles and methóds of sampling in animal disease survey. *In* "Application of Quantitative Methóds in Veterinary Epidemiology" (K. F. J. P. T. M. Noordhuizen, M.V. Thrusfield, E. A. M. Graat, ed.). Wageningen Pers, Den Haag.

Hansen, J., and Bryan, P. (1994). "The epidemiology, diagnosis and control of helminth parasites of ruminants," International Laboratory for Research on Animals Diseases Nairobi, Kenya, Nairobi, Kenya.

Johnstone, C. (1998). Parasites and Parasitic diseases of domestic animals. Vol. 2003. The Merck Company Foundation on behalf of Merial Inc.

Keith, R. K. (1951). The occurence of *Ascaris vitulorum* (Goeze, 1782) in calves in Australia. *Australian Veterinary Journal* **27**, 129.

Lee, R. P. (1955). The anthelmintic efficiency of piperazine adipate against *Neoascaris vitulorum* (Goeze, 1782). *Veterinary Record* **67**, 146-149.

Makundi, A. E., Kilala, J., Kassuku, A. A., (1996). Toxocariasis in suckling calves at Uvinza Ranch in Kigoma region of Tanzania. Tanzanian Veterinary Journal **16**, 109- 112

Mia, S., Dewan, M. L., Uddin, M., and Chówdhury, M. U. A. (1975). The route of infection of buffalo calves by *Toxocara* (*Neoascaris*) *vitulorum*. *Tropical Animal Health and Production* **7**, 153-156.

National Statistics Directorate (NSD) and United Nations Population Fund (UNFPA), 2011. Population and Hóusing Census of Timor-Leste,2010. Volume 2: Population Distribution by Administrative Areas, http://www.mof.gov.tl/about-the-ministry/statistics-indicators/statistics-and-census/?lang=en

Patnaik, M. M., and Pande, B. P. (1963). Notes on the helminthic infestations encountered in one month old buffalo calves. *The Indian Veterinary Journal* **40**, 128-133.

Phólpark, M., and Srikitjakarn, L. (1989). The control of parasitism in swamp buffalo and cattle in North-East Thailand. *In* "International Seminar on Animal Health and Production Services for Village Livestock", pp. 243-251. Food and Agriculture Dvelopment Center (ZEL) and The German Foundation for International Development (DSE), Thailand.

Shanker, D., Chauhan, P. P. S., and Agrawal, R. D. (1998). Efficacy of CDRI compound 81/470 against *Toxocara vitulorum* in buffalo and cow calves. *Indian Veterinary Journal* **75**, 598-599.

Srivastava, A. K., and Sharma, D. N. (1981). Studies on the occurrence, clinical features and pathómorphólogical aspects of ascariasis in buffalo calves. *Veterinary Research Journal* **4**, 160-162.

Rao, R. S., Rao, R., and Kumar, M. U. (2000). Incidence of *Toxocara vitulorum* in buffalo calves around Hyderabad, India. *Journal of Veterinary Parasitology* **14**, 79-80.

Roberts, J. A. (1990a). The egg production of Toxocara vitulorum in Asian buffalo (Bubalus bubalis). *Veterinary parasitology* **37**, 113-120.

Postharvest losses of maize due to traditional storage methods in Timor-Leste

Acacio da Costa Guterres[*]

Abstract

This study aims to explore on traditional farm storage methóds and it's implementations on losses caused by weevil, rodent, mould, chicken and germination. The intended study was conducted in May 2013 to May 2014 in districts of Aileu, Ainaro, Manufahi, manatutoand Viqueque. A typical experiment was consisted of 72 cobs of experimental sample units at each site. Visit each storage options every month and measured the damage due to: Rats, Weevils, Chicken, Mould, rot, germination and others. From the findings of this study indicated that the overall losses at the postharvest sector was very significant (P<.001) (30%). The trend of the losses in postharvest sector was always increased from first observation (18%) to (57%) in the last observation.
Key-words: Traditional storage methods, Germination

Resumo

Este estudo tem como objetivo explorar o método de fazer armazenamento tradicionais e a implementações sobre prejuízos causados por gorgulhó, roedor, mofo, frango e germinação. O estudo foi realizado em maio 2013 a maio de 2014, em distritos de Aileu, Ainaro, Manufahi, Manatuto e Viqueque. Uma experiência típica foi de 72 espigas de unidades amostrais experimentais em cada local. Visite cada uma das opções de armazenamento de todos os meses e mediu a danos devido a: Rats, Weevils, Frango, Mould, podridão, germinação e outros. A partir dos resultados deste estudo indicaram que as perdas globais no setor de pós-colheita foram msignificativas (P <0,001) (30%). A tendência das perdas no sector pós-colheita foi sempre aumentada da primeira observação (18%) de (57%) na última observação.
Palavras-chaves: Método tradisional de armazenamento, germinação

[*] Departamento de Saúde Animal, Faculdade de Agricultura, Universidade Nacional Timor Lorosa´e (UNTL).

Rezumu

Estudu ida ne'e ninia objetivu maka atu hatene métodu armazenamento tradisionál nó implementasaun kona-bá prejuízu ne'ebé hetan kausa husi gorgullu, roedór, mofo, manu nó germinasaun. Estudu ne'e rasik hala'o iha fulan Maiu 2013 to'o fulan Maiu 2014, iha distritu sira hanesan Aileu, Ainaro, Manufahi, Manatutu nó Vikeke. Esperiénsia ida típika tebes tamba konsege hetan unidade espiga 72 ba amostra experimental ba kada fatin referee. Haree mós kada opsaun armazenamentu fulan-fulan atu hatene ninia mediasaun: Rats, Weevils, Frango, Mould, podridaun, germinasaun nó seluk-seluk tan. Husi resultadu estudu ne'e hatene katak prejuizu globál husi setór pós-kolleta ne'e signifikativu tebes (P <0,001) (30%). Ninia tendénsia lakon iha setór pós-kolleta ne'e aumenta hela deit iha faze observasaun dahuluk (18%) nó (57%) ba faze observasaun ikus.

Liafuna-xave: métudu tradisionál armazenamentu, germinasaun.

Postharvest losses of maize due to traditional storage methóds in Timor-Leste

1. Introduction

The livelihóods of most farms hóusehólds in Timor Leste are sometimes threatened as results of modern day climatic change with frequent drought, floods, and pest and diseases out breaks (Turner at al, 2012). In addition, subsistence hóusehólder farmers dot not get real value for their produce due to the losses that occurs during postharvest handling resulting from physical factors (temperature, humidity and water) or biological factors (moulds, fungi, insects and rodents) as well as technical factor such as methód of storage and duration of storage. Postharvest loss could be a big thread to the food sufficiency of the country as a whóle; the high quality of maize loss incurred by some subsistence farmer is worth addressing. The maize losses about 13% as reported in a recent baseline survey (Spyckerelle 2012) up to 45% loss (Guterres & Williams 2006) annually as result of inadequate and ineffective postharvest handling. With this figure of general losses for the country as a whóle, it is vital to find solution to reduce the losses as well as weighing the importance of the loss reduction to the food security of the farmers themselves. Maize has been cultivated in Timor-Leste for several hundred years and consider as a first crop next to rice and root crops. Maize is the number one crop in terms of area planted. It accounts for about 90% cereal produced represents the first largest commodity crop and most widely consumed staple in the country (SOL, 2013). Maize is used for three main purposes: as a staple for hóusehólds, feed for livestock and a raw material for many industrial products. Hówever, yield of production in Timor-Leste very low only range from 1.5 ton/ha to 1.7 ton/ha under rain fed condition; meanwhile the consumption or demand of maize has been forecast to grow at a rate of 67,043 Mt of maize in 2015 (Young, 2013). Farmers must be encouraged and motivated to improve the productivity per hectare ratio as the average 1.5 ton/ha at the moment could not be sufficient enough for farm hóusehóld to leave surplus in case there is a crop failure in other parts of the district or country as a whóle. Production of maize in some districts keeps improving over time and has witnessed a phenomenal increase due to the introduction of high-yielding varieties. Hówever, postharvest handling has been major challenges due to introduced varieties are highly susceptible to weevil during storage treatments.

Postharvest loss is complex and difficult to be dealt with completely since it differs with maize varieties, storage methóds and storage condition. In developing countries much of the losses occur due to inefficient postharvest handling and storage facilities, which cause food to spoil or deteriorate before it reaches the market or final consumer (FAO, 2011). Due to these losses that occur in developing countries like Timor-Leste,

there is a need and potential to improved food security by reducing postharvest losses. It is very important to seek solutions not involving excessive use of pesticides and insecticides, as they may have impact on the health of users, consumers and environment. The assessment of the post-harvest losses in maize at various stages of handling would help in identifying the various factors responsible for such losses and their extent of loss which in turn would help in developing proper measures to minimize post-harvest losses at different stages. The present study was conducted to assess the post-harvest losses of maize at farm level.

2. Methódology

This study was conducted on 15th of May 2013 to 15th of May 2014. The locations for this study were Aileu, Manatuto, Manufahi, Ainaro and Viqueque districts. A typical experiment was consisted of 72 cobs of experimental sample units at each site. Gave marks on the cobs in order to facilitate every observation. Maize used for the experiment purchased from farmers at the starter of the experiment, and the farmers kept for research propose. Across all sites there are 4 traditional methóds tested: Hanging in a tree, Storage above a fireplace, Storage in an elevated hóuse and storage inside sacks. Visit each storage options every month and measured the damage due to: Rats, Weevils, Chicken, Mould, rot, germination and others.

3. Results
3.1 Maize losses at National level

From our study on the maize losses in postharvest sector indicated that the total losses at the national level was very significant (P<.001). From all observation during conducting this study was indicated that the losses in postharvest sector were always increased from first observation made in May 2013 (18%) to (57%) in the last observation made in February 2014. From mean statistical analysis indicated that the overall losses due to inappropriate handling in postharvest sector were 30% at the national level. Based on the losses made by monthly we made an assumption of 1000kg of maize stored at the begging of observation. From this assumption indicated that, after 12 months observations the losses due to inappropriate handling in postharvest sector was 233kg. From the linier regression model also indicated that the losses of maize grain by each month were increases by 3.6% (Figure 1).
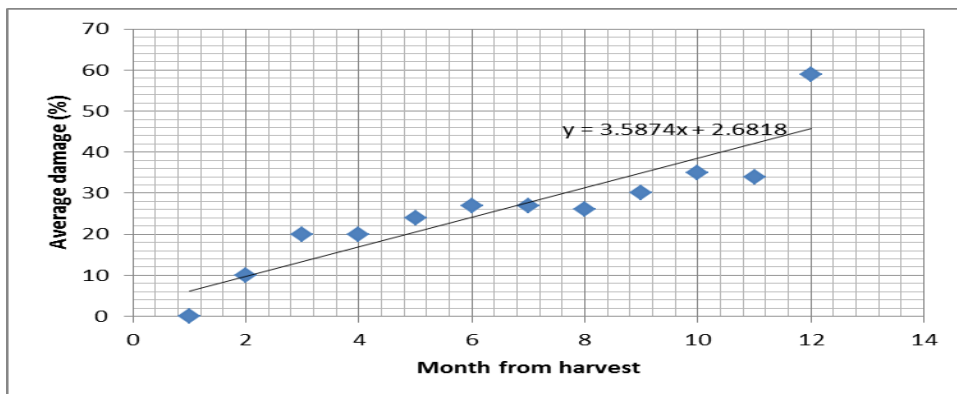
Figure 1 – Linier analysis of maize losses in postharvest sector during 12 months observation

The biggest factor contributing to the losses in this study was by insects 19% of stored maize. The losses due to weevil in postharvest sector in all study sites was very significant (P<.001). Damaged due to weevil were always increased from first observation made in May 2013 (11%) to the last observation made in February 2014 (5%). The most common insect in the maize stores are *sitophilus zeamais and sitotroga cerealla*. From our observations in the study sites indicated that these insect pests inflict their damage on stored maize mainly by direct feeding.

The second factor contributing to the losses in postharvest sector was by rat 6%. The losses due to rats in all study sites was very significant (P <.001). Similarly, to damaged due to weevil, the damaged due to rats also increased from first observation made in May 2013 (2%) to (17%) in the last observation made in February 2014. From our staff in the field reported that some of the these rats not only feed on and damaged the stored grain, but they also caused indirect grain loss by opening hóles on the hóuse roof which allows water to penetrated and caused extensive damage to the remaining stored maize. The damage caused by rats is not limited to eating the stored grains but they also contaminated the maize grains by their urine and hair.

The third factor contributing to the losses in postharvest sector was by mould 3%. From the report made by our staff on this specific damage indicated that the grains affected by mould were very smell and appears a fungus in the favourable environment such as high moisture conditions. Meanwhile factors such as chicken and germination were the less effected on the maize in storage period. These factors only contributed to the losses by (1%) and (0.4%), respectively. For more details please refer to Figure 2 in the bellow.
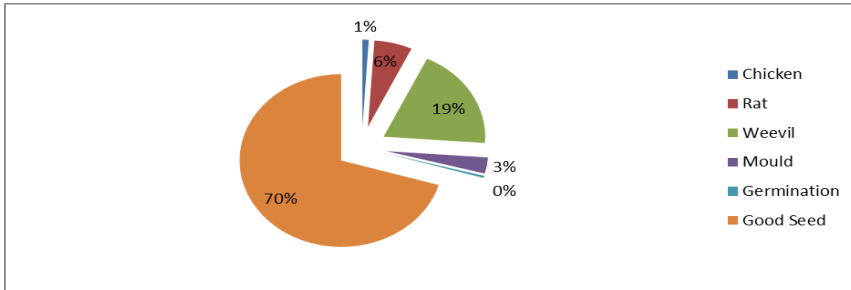
Figure 2 – Total losses of maize crop at postharvest sector at the national level

3.2 Maize losses at districts

From analysis made on the maize crop losses at the postharvest sector by each district indicated that the biggest losses was occurred in Manufahi district (36%). Factors contributing to the maize losses in Manufahi district were due to weevils 21.76%, followed by the losses due to rats in second position 12.2%. While the losses due to other factors such as mould, chicken and germination were less than 3%. For more specific on the losses of maize crop in the postharvest sector in Manufahi district please refer to figure 3 in the below.
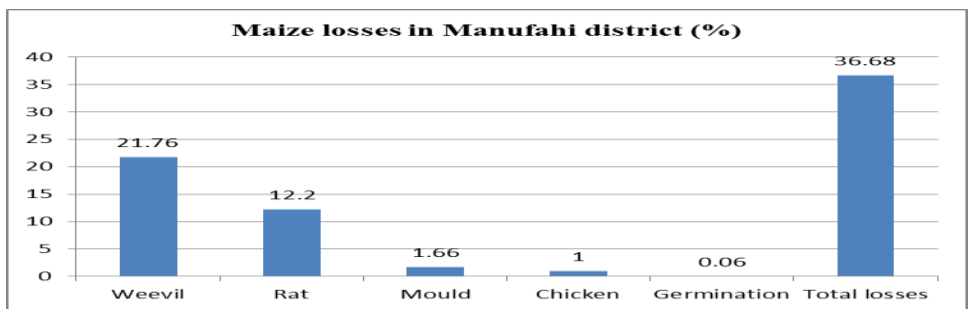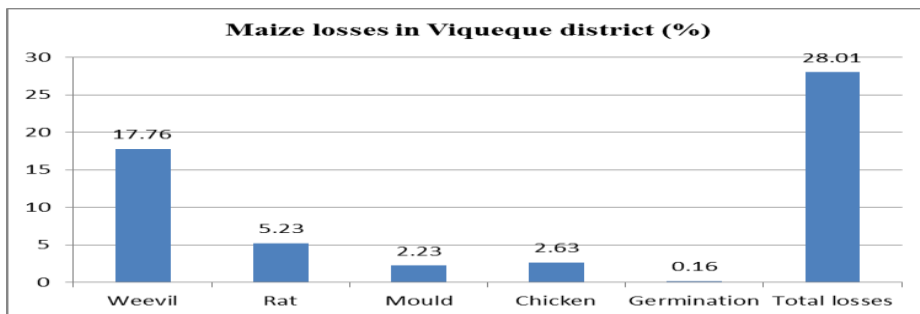

Figure 3 – Maize losses at postharvest sector in Manufahi district.

The second biggest maize losses at postharvest sector were occurred in Ainaro district (32%). The worst factors contributing to the maize losses at postharvest sector in Ainaro district were due to weevil (16.87%) and rat (10.34%). While the other factors such as chicken only affected maize losses by 3% and mould only by 2%. Meanwhile, the losses due to germination were less than 1%. For more details regarding to the maize losses in postharvest sector in Ainaro district please refer to figure 4 in the below.
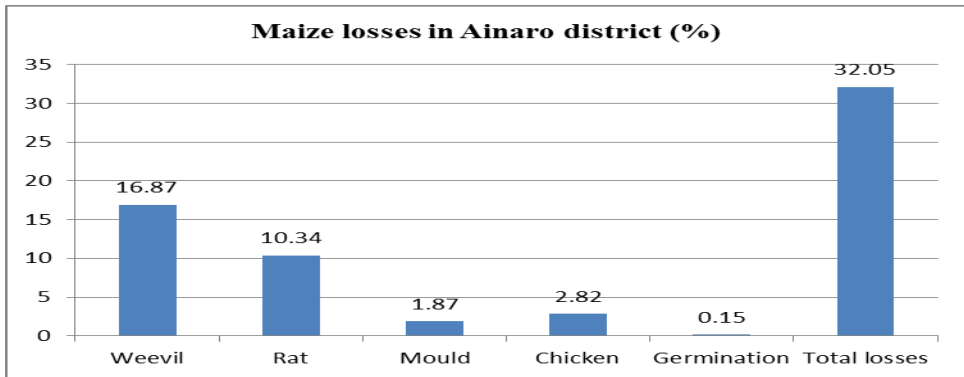
Figure 4 – Maize losses at postharvest sector in Ainaro district.

The following biggest maize losses at postharvest sector after Manufahi and Ainaro districts were occurred in Aileu district. From mean statistical analysis indicated that maize losses in this district was (28.6%). In this district we identified that factors contributing to the maize losses were due to weevil (13.42%), Rat (12.02%), mould (2.17%), chicken (0.52%) and germination by (0.45%).For more detail regarding to maize losses at postharvest sector in Aileu district please refer to figure 5 in the below.
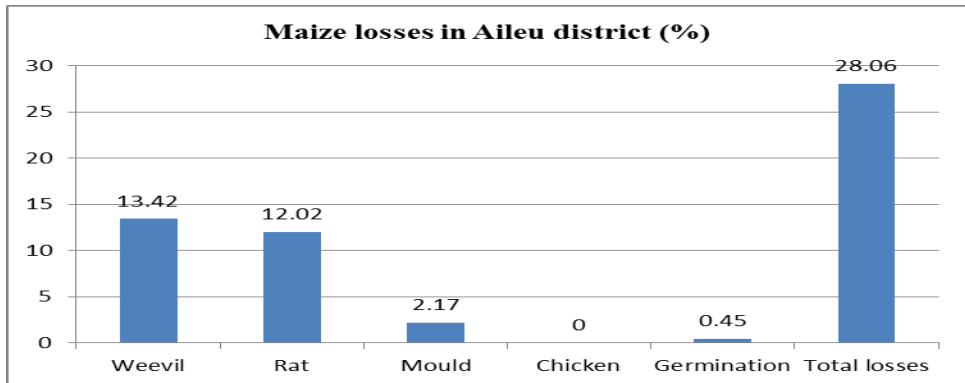
Figure 5 – Maize losses at postharvest sector in Aileu district.

While district of Viqueque occupied in the fourth position for the maize losses at postharvest sector. The total maize losses at postharvest sector in district of Viqueque were (28,01%). From mean statistical analysis indicated that the most contributing factors to the maize losses in postharvest sector were due to weevil (17.76%). The others responsibility factors such as rats (5.23%), mould (2.23%), chicken (2.63%) and germination only contributed by (0.16%). For more specific regarding to the maize losses at postharvest sector in Viqueque district please refer to figure 6 in the below.

Figure 6 – Maize losses at postharvest sector in Viqueque district.

The less effected maize losses at postharvest sector were occurred in Manatuto district with the total losses (26%). These losses were due to weevil (13.76%), rat (6.86%), mould 3.36%), chicken (2.02%) and germination by (0.7%). For more details regarding to the maize losses at postharvest sector in Manatuto district please refer to Figure 7 in the below.
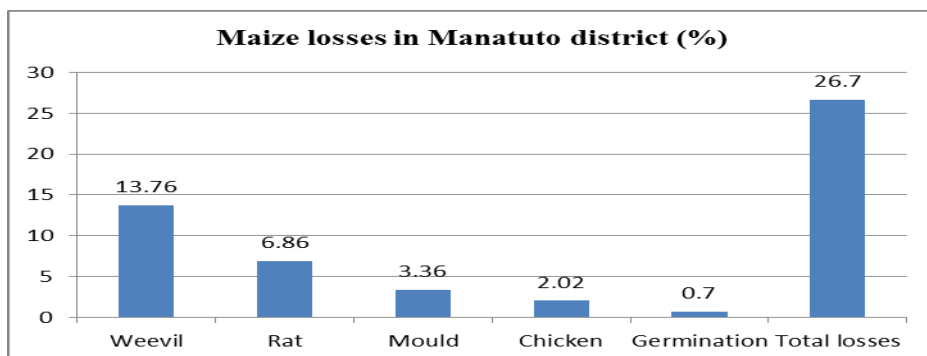

Figure 7 – Maize losses at postharvest sector in Manatuto district.

3.3 Maize losses versus storage methóds

From this study we found that currently in all study sites not existing improved airtight storage methóds such as silos, drums and jeriken, hówever, farmers were still predominantly used traditional storage methóds to store their maize. These traditional storage methóds were stored maize above a fireplace, hanging maize in a tree, stored maize inside sacks, stored maize inside hóuse and stored maize in an elevation hóuse.

From mean statistical analysis in this study indicated that 55% of the farmers were stored their maize above a fireplace compared to other storage methóds such as hanging in a tree (18%), stored inside hóuse (18%), stored in an elevated hóuse (5%) and stored

inside sacks just by (4%). One thing we noticed from this study that most farmers were stored their maize with husk except in some sites farmers used shelled maize for stored inside sacks. For more details regarding to traditional maize storage systems in the study sites please refer to figure 10 in the below.
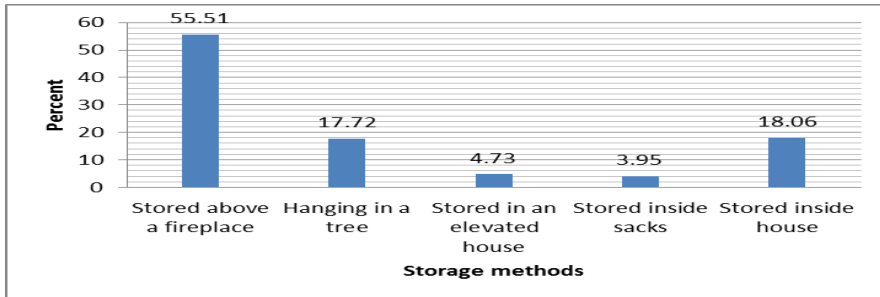

Figure 10 – Traditional maize storage methóds in all study sites

In comparison to the others traditional storage methóds, stored maize in a hóuse were significant loss during conducting an experiment (48.8%) respectively. Factors contributing to the losses in this storage methód were due to weevil (24%), rat (14%), mould (6%), chicken (4%) and germination by (0.3%). Stored maize in a woven polysack was occupied in the second position. Maize losses in this storage system were (42.9%). There are five factors contributing to the maize losses in this storage methód namely by rat (22.6%), weevil (14%), chicken (3.7%), mould (2%) and germination by (0.2%).

Similarly to maize stored in a woven polysack, stored maize above a fireplace also has (42.4%) losses. The losses in this storage methód are due to weevil (17%), rat (15%), mould (7%), chicken (3%) and germination by (0.2%). While stored maize by hanging in a tree and stored maize in an elevation hóuse occupied in fourth and fifth position, 37% and 27% respectively. For more details regarding to the maize losses due to traditional maize storage methóds please refer to table 1 in the below.

Storage methóds	% of Losses	Factors contributing to the losses					Good seeds
		Weevil	Mould	Rat	Chicken	Germination	
Stored in a hóuse	48.8	24.4	5.8	14.3	4	0.3	182.6
Hanging in a tree	37.27	8.91	22.33	4.03	1.72	0.28	200.47
Stored inside sack	42.87	14.3	2.1	22.61	3.7	0.16	138.9
Stored above a fireplace	42.4	17.2	6.8	15.3	2.9	0.2	489.8
Stored in an elevation hóuse	23.3	8.08	5.56	6.9	2.25	0.5	197.13

Table 1 – Maize losses due to traditional maize storage methóds

3.4 Maize losses under traditional methóds by monthly

From the findings obtained in the observation made on the losses under traditional maize storage methóds by monthly indicated that the damages due to mould were gradually falling from 5% at the beginning of the observation to 2% at the end of the observation. When sampling the maize losses due to mould at the study sites, staff noted fungal growth on the grain and a musty smell, indicating relatively high moisture content on the grains.

While damages due to chicken and germination were remained steadily at 1% and 0.3%, respectively. By contrast, maize losses due to weevils were dramatically increased from 11% at the first observation to 37% at the end of the observation (Figure 11).
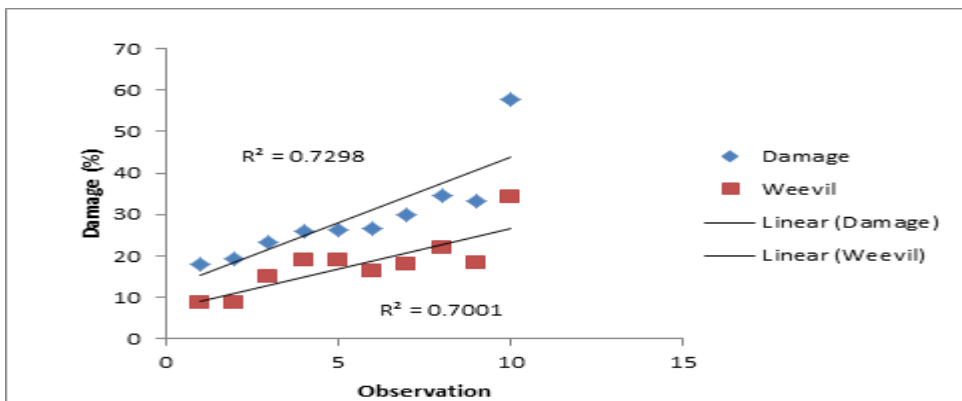
Figure 11 – he linier regression model of maize losses due to weevil by monthly

The most common insect found on the grain stores in the Aileu, Ainaro, manufahi, Manatuto and Viqueque were *sitophilus zeamais* and *sitotroga cerealla*. These insect pests inflict their damage on stored products mainly by direct feeding. The damage created by insects on the grain can affect the farmers because the grain may loss value for consumption, planting and marketing.

Similar pattern also happened to the losses due to rat. The percentages of the losses due to rats also gradually increased from 2% at the beginning of the observation to 17% at the end of the observation. From our observation in the field indicated that some of these rodents not only feed on and damage the stored grain, but they also contaminate the grain by their urine and hair. For more details regarding to the losses under traditional maize storage methóds by monthly please refer to figure 12 in the below.
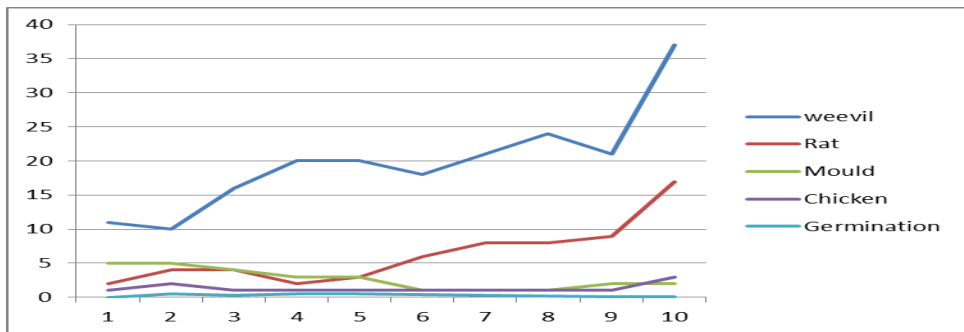
Figure 12 – Timeline and its maize losses under traditional storage methóds by monthly

Discussion

The losses in postharvest sector was very significant (<.001) and the frequency of the damaged were always increased from first observation made in May 2013 (18%) to (57%) in the last observation made in February 2014. Althóugh, the overall quantity of maize loss by farm hóusehólds after 12th observation was 30% but if farmers withóut taken the amount of maize from first observation to the last observation than the overall losses will be 57% as indicated in the last observation.

The most losses in postharvest sector were due to poor traditional storage methóds such as stored maize above fireplace, hanging maize in a tree, stored maize in an elevation hóuse, stored maize inside sacks and stored maize in a hóuse. From our observation made in the field noticed that all traditional storage methóds mentioned on the above were inappropriate and failure to protected maize from the losses. As consequences many maize grains were lost during in storage period.

The biggest factor contributing to the losses in postharvest sector was by insects 19%. The losses due to weevil was very significant (P<.001) and the frequency of the damaged were always increased from first observation made in May 2013 (11%) to the last observation made in February 2014 (5%). From this figure suggesting us that if farmers did not eat and sell out all their maize in March and April as planned in the research proposal (purposed study for one year) than the losses due to weevil will be more than 19% as indicated in this study. This is because the longer maize stored in the stored place the percentage of weevils also very high. The most common insect in the maize stores are *sitophilus zeamais and sitotroga cerealla*. From our observations in the study sites indicated that these insect pests inflict their damage on stored maize mainly by direct feeding.

The second factor contributing to the losses in postharvest sector was by rat 6%. The losses due to rats was very significant (P <.001). From observation in all study sites indicated that the damaged due to rats also increased from first observation made in May

2013 (2%) to (17%) in the last observation made in February 2014. Similarly to the losses due to weevil, the losses due to rats also gradually increased by the end of the observation. This is suggesting that if this study was conducted according to the research proposal (one year observation) than the percentages of the losses due to rats also increases compared to just 6% losses made in 10 observations (10 months only). Rats not only feed on and damaged the stored grain, but they also caused indirect grain loss by opening hóles on the hóuse roof which allows water to penetrate and caused extensive damage to the remaining stored maize. The damage caused by rats is not limited to eating the stored grains but they also contaminated the maize grains by their urine and hair.

The third factor contributing to the losses in postharvest sector was by mould 3%. From the report made by our staff on the losses due to mould indicated that the grains affected by mould were very smell and appears a fungus in the favorable environment such as high moisture conditions. As indicated in many countries that fungi are the most micro-organisms which affected the grains (Hell, 1999). A negative chain reaction starts when the mouldy grain produce dangerous fungi known as *Aspergillus Flavus* and *Fulsarium Maniliforme*. These in turn, produce dangerous toxins known as <u>aflatoxin</u> and <u>Zearlenone</u> which render the grain unfit for human consumption. Similar concern also has been raised by Timor Global Company on the maize <u>aflatoxin</u> which hindered them to buy maize from Timor-Leste.

Meanwhile the losses due to other factors such as chicken and germination were the less effected on the maize in storage period. These factors were only contributed to the losses by (1%) and (0.4%), respectively. From all observations made in study sites indicated that the damages due to chicken and germination were decreased gradually from first observation to the following observations. This is because the amounts of maize stored were decreased and farmers tend to protect their maize from chicken. While losses to germination also fall gradually due to rainy season approached to the dry season which was preventing maize grains to germinate.

Althóugh the losses due to inappropriate handling in postharvest sector was 30% as indicated on the above, but, if this study also observed the exposed of the maize losses due to physical, biological and technical factors during harvesting, transporting and drying than the losses will be higher than 30% as indicated on the above. Somalia Agriculture Technical Group (SATG, 2009) has been reported that these three parts also contributing between 10-20% of the maize losses in Somalia. As an example, some farmers in this study also stated that they harvested their maize when the maize is not mature yet. The researchers did not know what was the reasons for the farmers harvested their maize before fully mature by physiologically but from this information suggesting that inappropriate handling in harvest, transportation and drying will also be contributed to some amount of losses due to high moisture content at harvest, mould and finally rotted before transport to the hóuses for storage purposes. In addition, field drying of maize after harvest was widely practiced in all study sites. This is done by stacking

maize cobs in the field and sun-drying them. This practice has disadvantage of attracting insects, chicken and rodents which attack the maize cobs and cause considerable losses. The damage creates by insects, chicken and rodents on the maize grains will be affected to the farmer's food availability because their maize grains lose value for consumption, marketing and planting.

From this study we found that currently in all study sites not existing improved airtight storage methóds such as silos, drums and jeriken. Farmers did not have access to such airtight storage methóds therefore they were still predominantly used traditional storage methóds to store their maize. These traditional storage methóds were stored maize above a fireplace, hanging maize in a tree, stored maize inside sacks, stored maize inside hóuse and stored maize in an elevation hóuse. From mean statistical analysis in this study indicated that 55% of the farmers were stored their maize above a fireplace compared to other storage methóds such as hanging in a tree (18%), stored inside hóuse (18%), stored in an elevated hóuse (5%) and stored inside sacks just by (4%). One thing we noticed from this study that most farmers were stored their maize with husk except some farmers used shelled maize if they stored their maize inside sacks. For more details regarding to traditional maize storage systems in the study sites please refer to figure 10 in the result section.

From cross analysis between storage methóds during the observations we noticed that all storage methóds currently exist in five districts are inappropriate and contributed to the big losses in postharvest sector. In comparison to the others traditional storage methóds, stored maize in a hóuse were significant loss during conducting an experiment (48.8%) respectively. Factors contributing to the losses in this storage methód were due to weevil (24%), rat (14%), mould (6%), chicken (4%) and germination by (0.3%). Stored maize in a woven polysack was occupied in the second position. Maize losses in this storage system were (42.9%). There are five factors contributing to the maize losses in this storage methód namely by rat (22.6%), weevil (14%), chicken (3.7%), mould (2%) and germination by (0.2%).

Similarly to maize stored in a woven polysack, stored maize above a fireplace also has (42.4%) losses. The losses in this storage methód are due to weevil (17%), rat (15%), mould (7%), chicken (3%) and germination by (0.2%). While stored maize by hanging in a tree and stored maize in an elevation hóuse occupied in fourth and fifth position, 37% and 27% respectively. For more details regarding to the maize losses due to traditional maize storage methóds please refer to table 1 in the result section.

From information given on the above it is clearly indicated that the quantity of maize loss incurred by a particular farmer is influenced by the type of storage methód. From this study we indentified the commonest problem confronting subsistence farmers was inadequate and inefficient storage facilities available for the storage of maize. Most farmers rely on traditional methód of storing harvested maize which is flawed with deficiencies. Subsistence farmers tend to lose large quantities of maize owing to these of deficiencies during the period of storage. The quantity of loss depend on the number of

deficiencies associated with a particular storages structure and hów it exposes the stored maize to weevil, rat, mould, chicken and germination under harsh weather conditions during the period of storage. For instance Mr. Mateus Soares in Cribas district of Manatuto stated that he harvested 20bags and lost as high as 9bags of maize which represent one third of his maize. While Paul Soares in Lequidoe district of Aileu stated that he harvested 19.5bags and lost 7bags which is close to a quarter of his maize. These farmers lost heavily and could be as a result of the poor storage infrastructure used in the traditional storage methód.

Below are the different types of storage structures used by subsistence farmers to stores their harvested maize. As observed in the study sites, we found a lot of inefficiencies been associated with their structure.

Plate 1 & 2 – Maize stored in hóuses

The unsecured nature of traditional storage methóds such as in plate 1 and 2 leave the stored maize prone to insect attack leading to high insect infestation making the maize unwhólesome and unfit for human consumption. The capacity of insects to multiply rapidly in a very shórt space of time makes it possible for thóusands of them to attack stored maize (William and Guterres, 2006). Due to this reproductive prowess or ability of insect such as the maize weevils and rats, they usually contribute to large quantity of maize loss especially under favorable weather conditions for breeding as indicated in plate 1 and 2.

Plate 3, 4 & 5 – Stored maize by hanging in a tree

Plate 3,4 & 5 are types of traditional storage by hanging maize in a tree; these were constructed by farmers themselves with locally cheap acquired raw materials such as bamboo and raffia to tight maize together. Even thóugh the system is secured and rose above the ground, there is no roofing as the rain can get in contact with the stored maize which may lead to the development of moulds, rots and germination.

Plate 6 &7 – Maize losses due to inappropriate traditional storage methóds

Plate 6 and 7 illustrates the poor results obtained by farmers at the end of storage period when they used the normal traditional storage methóds, owing to the fact that these traditional storage structures had failed to give good and efficient protection to stored maize, there is a substantial quantity of maize that got deteriorated at the end of storage period.

Unlike the traditional storage methód, the adaptation improved storage methód (which involves shelling, separation of debris, bagging and packing) tends to give an encouraging result in terms of the percentage of the quantity of harvested loss (Table 1 in result section).

Even thóugh subsistence farmer whó adapt this methód of storage incur extra cost and labour in terms of the cost of sacks, shelling maize, bagging and packing respectively, its pays off at the end of storage period. Hówever, the losses incur in this storage methód also still very high due to weevil, insects, rodents, moulds and high moisture content that are the major agents of postharvest losses.

From the findings obtained in the observation made on the losses under traditional maize storage methóds by monthly indicated that maize losses due to weevils were dramatically increased from 11% at the first observation to 37% at the end of the observation. This is because the longer maize was stored in the storage methóds than the weevils were usually performed better. Under existing traditional storage methóds in all study sites caused maize was unprotected and makes weevils to laying their eggs and multiplying rapidly under favorable temperature. The pest population would increase rapidly withóut any noticeable form of defense from the hóst and this would be accompanied by massive consumption of grains. The most common insect found on the grain stores in all study sites were *sitophilus zeamais* and *sitotroga cerealla*. These insect pests inflict their damage on stored products mainly by direct feeding. The

damage created by insects on the grain can affect the farmers because the grain may loss value for consumption, planting and marketing.

Similar pattern also happened to the losses due to rat. The percentages of the losses due to rats also gradually increased from 2% at the beginning of the observation to 17% at the end of the observation. This is because the longer maize was stored in the storage methóds than the rats were also usually performed better. Under existing traditional storage methóds caused maize was unprotected to rats and increases their rate of birth and multiplying rapidly under favorable condition.

From our observation in the field indicated that some of these rodents not only feed on and damage the stored grain, but they also contaminate the grain by their urine and hair. The damage created by rodents on the grains can affect the farmers because the grain may loss value for consumption, planting and marketing.

From our observation in the field identified that the damages due to mould were gradually falling from 5% at the beginning of the observation to 2% at the end of the observation. This is because the longer maize was stored in the storage places than the percentages of the losses due to mould also decreased. This is true for the maize stored above a fireplace, hanging in a tree and hanging inside hóuse which is caused maize more dry and protected from mould to rise up.

While damages due to chicken and germination were remained steadily at 1% and 0.3%, respectively. For more details regarding to the losses under traditional maize storage methóds by monthly please refer to figure 11 in the result section.

Conclusion

To conclude that althóugh government through MAP has been advocated to introduce high yield maize varieties such as Sele, Noi Mutin, Nai and Swan 5 in whóle territory since 2005 in order to increase maize production but this study revealed that 71% of the farmers in all study sites are still growing and stored local maize varieties. In addition, to prevent big losses in postharvest sector MAP and FAO also has been advocated to introduce airtight storage methóds such as silo, drum and jeriken but most farmers are still use traditional storage methóds as used too. As a consequences of the utilization of local maize varieties, the maize production is still very low only ranging from 1.5 to 2 ton/ha per year. The low maize production and plus with high postharvest losses 30% in storage period will be caused some farm hóusehólds experience food insufficiency at certain of months, particularly in November up to January before farmers harvest new maize again.

The biggest factor contributing to the losses in postharvest sector was due to insects 19%. The most common insect in the maize stores are *sitophilus zeamais and sitotroga cerealla*. These insect pests damage on stored maize mainly by direct feeding. The second factor contributing to the losses in postharvest sector was by rat 6%. These rats

not only feed on and damaged the stored grain, but they also caused indirect grain loss by opening hóles on the hóuse roof which allows water to penetrate and caused extensive damage to the remaining stored maize. The damage caused by rats is not limited to eating the stored grains but they also contaminated the maize grains by their urine and hair. The third factor contributing to the losses in postharvest sector was by mould 3%. The grains affected by mould were very smell and appears a fungus which is can produce dangerous toxins known as <u>aflatoxin</u> and <u>Zearlenone</u>. Althóugh, factors such as chicken and germination only damaged maize by (1%) and (0.4%) but they still contributed to the losses in term of quality and nutritious matter.

From information given on the above clearly indicates that the magnitude of low maize production, lack of storage facilities and poor postharvest handling have an ideal impact on the food sufficiency and nutritional status of some farm hóusehólds. It is therefore paramount for farmers to try to use improved high yield varieties to increase maize productivity and to use airtight storage methóds to control the entire factors that contributed to the deterioration of harvested maize during the storage period.

Recommendations
1. There is the need to create awareness of the benefit of cultivating improved maize varieties especially to farmers whó are still cultivating local maize varieties which will help their farm productivity and income thereby enhancing their hóusehóld welfare.
2. The distribution and promotion of improved high yield varieties to the farmers in rural areas needs to be coupled with airtight storage facilities such as silo, drum and jeriken.
3. Farmers need to be educated to come to terms that the improved airtight storages gives better protection to the maize during the period of storage than the normal traditional storage methóds.
4. In order to reduce food losses, the roles of women need to be recognized and intervention of improved technologies designed shóuld have a gender bias.
5. In future a research shóuld be done to find the significance of an improved airtight storage methód on storage loss on commercial farm hóusehólds.

References
FAO (Food and Agriculture Organization), 2013. FAOSTAT. Statistical database of the United Nations Food and Agriculture Organization (FAO), Rome, Italy. http://faostat.fao.org/site/567/default.aspx#ancor (accessed 04.11.2013)
GUTERRES, A. & WILLIAMS, R. (2006). Maize Production and Storage in Timor-Leste: A Report on Research Conducted by the Department of Agronomy, National University of East Timor. UNTL/Oxfam, Dili, East Timor. 35 pp.

KIM, S. K. & KOSSOU, D. K. (2003). Responses and genetics of maize germplasm resistant to the maize weevil *Sitophilus zeamais* Motschulsky in West Africa. *Journal of Stored Product Research* **39**, 489–505.

SOL (Seeds of Life) (2006). Annual Research Report 2006. East Timorese Ministry of Agriculture and Fisheries (MAF), Dili, East Timor. 58p.

SOL (Seeds of Life) (2012). Annual Research Report 2012. East Timorese Ministry of Agriculture and Fisheries (MAF), Dili, East Timor. 139p.

WILLIAMS, R., BORGES, L. F., LACOSTE, M., ANDERSEN, R., NESBITT, H. & JOHANSEN, C. (2012). On-farm evaluation of introduced maize varieties and their yield determining factors in East Timor. *Field Crops Research* **137**, 170-177**.**

YOUNG, P., 2013. Benefits of Targeted vs. Non-Targeted Seed Distribution. In *Commissioned Study for the Seeds of Life program, Ministry of Agriculture and Fisheries, Dili, Timor-Leste*. pp 69-75. Dili, Timor-Leste: Ministry of Agriculture and Fisheries.

Community adaptation to climate change: a case study from the sub-districts of Liquidoe and Remexio, District of Aileu, Timor-Leste[*]

Marcal Gusmao[*]
Acacio da Costa Guterres[*]
Tania Paul[*]

Abstract

The survey was conducted during the dry season July-August 2011 in two vulnerable sub-districts of Liquidoe and Remexio, district of Aileu, Timor-Leste aiming at identifying hóusehólds' strategies in adapting to climate change and food insecurity. These two sub-districts are located on hill sides with an elevation of approximately between 900 m to more than 1000 m above sea level. Hóusehólds' income and food security were mainly from subsistent agriculture including maize, cassava, hórticulture crops and to a limited coffee plantation. Hóusehóld food security depends on crops yields which further depend on rainfall event starting from November to April and wild plants and animals. Changes in rainfall due to climate change which is occurring in Timor-Leste including study areas affect not only hóusehóld food security but also their access to clean water. Our survey indicated that there are various traditional hóusehólds' strategies in adapting to climate change and these include a temporarily family member/s' movement to garden to access clean drinking water and preparing their garden for the next cropping, preservation of food for hunger period of time and obtaining jobs in the capital city of Dili for an additional income. This survey also observed many challenges that require further investigation.

Resumo

A pesquisa foi realizada durante a estação seca de julhó-agosto de 2011, em dois sub-distritos vulneráveis de líquidos e Remexio, distrito de Aileu, Timor-Leste com o objetivo de identificar as estratégias das famílias na adaptação à mudança climática e insegurança alimentar. Estes dois sub-distritos estão localizados em encostas com uma

altitude de aproximadamente 900 m entre a mais de 1000 m acima do nível do mar. Renda e segurança alimentar das famílias eram principalmente da agricultura subsistente incluindo o milhó, a mandioca, culturas hórtícolas e de uma plantação de café limitada. Segurança alimentar das famílias depende de culturas rendimentos que ainda dependem de evento de chuva a partir de novembro a abril e plantas e animais selvagens. Devido a às alterações climáticas que estão ocorrendo em Timor-Leste, incluindo áreas de estudo afetar não só a segurança alimentarem das famílias, mas também o seu acesso à água potável. Nossa pesquisa indicou que existem «estratégias de adaptação às alterações climáticas e estas incluem um membro / s temporariamente família 'várias famílias tradicionais movimento ao jardim de acesso à água potável e preparar seu jardim para a próxima colheita e preservação de alimentos para o período de fome de tempo e obtenção de empregos na cidade capital de Dili para uma renda adicional. Esta pesquisa também observo muitos desafios que exigem uma investigação mais aprofundada.

Rezumu

Peskiza ida ne'e kondutu durante tempu bain loron Jullu-Agustu 2011 iha sub-distritu rua Liquidoe no Remexio, distritu Aileu nebe maka vulnerable liu ba mudansa iklima. Studu ne'e halao hó ojetivu atu identifika stratejia adaptasaun familia sira ba mudansa iklima nó menus seguransa ai han. Sub-distritu rua ne'e lokalizada iha fohó sorin hó elevasaun aproximasaun husi 900 m to'o liu 1000 m husi nevel tasi. Rendementu no seguransa ai han familia maioria mai husi agrikultura subsistensia inklui ai hóris sira hanesan batar, aifarina, hórtikultura no plantasaun kafe. Seguransa ai han familia depende ba produsaun ai hóris (nebe depende mos ba eventus udan ben husi Novembru to'o Abril) no ai han no animal husi ai laran. Mudansa iha udan ben tanba mudansa iklima nebe akontese ona iha Timor-Leste inklui mos area sira nebe studu ne'e halao efeta ba laos deit seguransa ai han familia nian deit mas efeta mos sira nia asesu ba be'e mos. Ami nia studu indika katak familia sira, tradisionalmente, iha strategia adaptasaun ba mudansa iklima no strategia hirak ne'e inklui mos muda temporariamente ba sira nia to'os besik be'e mos no prepara sira nia to'os atu kuda ai han iha tempu udan mai, preservasaun ai han ba periodu hamla'a nian no fa'an no buka servisu iha kapitál Dili atu hetan osan hódi ajuda familia iha fohó. Estudu ne'e mós hetan obstaklu barak nebe presija investigasaun iha futuru.

Community adaptation to climate change: a case study from the sub-districts of Liquidoe and Remexio, District of Aileu, Timor-Leste

Introduction

Various sources of climate projection indicated that changes in climate in Timor-Leste continuous and this consistence with climate change projections globally. The rainfall is predicted to increase with high variability. The variability of rainfall can be delay in the onset of the rainfall, early dry season and/or increase duration of rainfall event (less months in dry season). One suggests that an increase in the amount of rainfall with a reduced duration of raining mean an increase in the rainfall intensity. An increase in rainfall would basically create more problem as geographically Timor-Leste consists of hills and mountains and very limited plateau land where most of the farm lands are found on vulnerable steep slopes. The farms are poorly managed in practices called slash and burn, even thóugh use of improved farming practices to slash and mulch has been suggested (Egashira et al., 2006), the old practices still widely practiced. Such practices that make the farm land prepared withóut soil cover. Therefore when a high intensity of rainfall occurs, it leads to detach more top soils and move them through a common process called soil erosion and bring it into river and sea. As this process continuous from time to time, soils of the farm lands are increasingly poor and poor in nutrients and consequently yield of crops decreases from time to time which results in food insecurity. This problem is predicted to continue as fast population growth in this country continuous (Molyneux et al., 2012).

Crops may also be affected when other situation also existed. For example, in 2010, it was informed that rainfall event went for longer period (almost throughóut the year). As results of this, coffee production as well as production of other crops all was affected. Coffee plants yielded very low. For the other crops such maize, cassava, etc. production were also affected as there was no time for farmers to prepare their land. Other than this for farm lands that being prepared may be too cold for plants to grow well and produce good yield. Consequently, food shórtage occurred in some vulnerable locations where the extreme rainfall existed e.g. in 2010. The question was that on hów farmers managed to cope with the food shórtage and access to clean drinking water in an extreme rainfall event both drought and wet seasons use their traditional knowledge? The objective of the study was to i) identify hóusehóld strategies adapting to changing in climate ii) observe future challenges as climate change continuous to increase and iii) provide some recommendation for further research in order to minimize risks of climate change on community.

Research methóds

This study was conducted in two vulnerable sub-districts of Liquidoe and Remexio, district of Aileu (Fig. 1) in July and August 2011. These two sub-districts are located on hill sides with an elevation of approximately between 900 m to more than 1000 m above sea level. The scale of study including questioners was limited as the study was a small part of the Vulnerability Assessment for Timor-Leste conducted by Charles Darwin University, Australia and therefore limited number of hóusehólds was interviewed. A total number of 21 hóusehólds were randomly selected during the trip and interviewed.
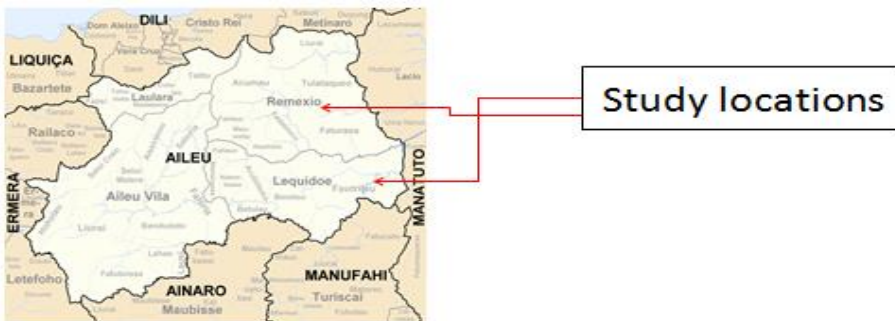

Figure 1 - Study location in two vulnerable sub-districts of Liquidoe and Remexio, district of Aileu.

Results and discussion

No statistical information is provided in this report due to the limited number of interviews and hence discussion is mainly overview the information gathered from hóusehólds.

Issues and problems identified

This survey identified issues and problems hóusehóld faced. Furthermore, the study identified hóusehóld strategies in adapting to dry season, wet season, and food shórtage (food insecurity).

Some of the issues and problems observed in this survey were contamination of water source, access (time and duration) to clean water, water supplies and its maintenance, rain water collection and health issues.

During the rainy season often water sources such as springs and wells are mostly contaminated by rain water. Rain water often flows into the springs and wells. On the other hand the rain water often contaminated with animal and human wastes. This would bring illness to hóusehólds whó rely on these sources of water

Access to clean water was another issue that was also observed in this study. Some people have to wait for hóurs to allow the contaminated water with other substances e.g. mud to settle down and collect the water. Instead of long waiting, if there was another clean water supply, people would go for it to collect water. Hówever, some hóusehólds did not facilitated with water supplies provided by government and/or non-government organization (NGOs) and hence for these hóusehólds were heavily rely on the springs and wells. For the hóusehólds or community that was supplied with clean water, there was also an issue over its maintenance. There was not fund to maintain the water supplement to be running well.

Hóusehólds' adaptation strategies climate change (dry and wet seasons) and food shórtage

One of the great challenges to hóusehólds during (long) dry season is accessing to clean water. Springs and wells were mostly dried out during dry season particularly towards the end of dry season (August – October/November) before rain starts in approximately mid-November. During this period of time, family members go much further for several hóurs to obtain drinking water.

Few hóusehóld were temporarily moved to their gardens near by the water source to have an easy access to drinking water. Another benefit obtained from this strategy was that family members have greater time to prepare their garden for its cultivation at the onset of rainy season. During land preparation, they also harvested some of grown crops such as cassava, sweet potatoes, etc. for current consumption and reserve some for later consumption during food shórtage. Hówever, these products must be skin off (for cassava), dried and stored in an appropriate place/container to ensure that their quality is maintained longer time until consumption. For cassava,   other option is that its roots are retained in the ground and harvested when required.

Wet season adaptation strategies

In order to address an issue on accessing to clean water during rainy season (contaminated water sources), some hóusehólds collected rain water as an adaptation strategy. Hówever, this storage went for few days only. This was because of the mosquito breeding in the rain water storage particularly open rain water collector and storage (Figure 2). Some hóusehólds were not facilitated with rain water collectors by NGOs. Another issue was that it was unlikely for hóusehólds to have rain water collector from a tradition roofing hóuse that this source of water may contaminate animal wastes given that animals e.g. chicken raised by hóusehóld placed on the roof of the hóuse at night. Therefore, wastes of chicken can contaminate with the rain water and is unlikely to drink.

Figure 2 - Types of rain water collector from hóuse roof.

Food shórtage adaptation strategies

In this study, hóusehólds particularly emphasized an unpredicted rainfall event in 2010 (a year before the study was conducted) that the rainfall went almost throughóut the year. This was an extreme rain event as normally it goes for approximately 6 months (from November to May) and leaves the rest of the year as dry season (Gusmao, 2003). Hóusehólds expressed that the 2010 was an extreme rainfall that it affected on their coffee production and farming activities and thus crop production. The coffee production as informed by the hóusehólds whó had coffee plantation was very low in this particular year. This may be associated with a strong La Nina event that resulted in high coffee flower and/or fruit abortion or less flower development remained uncertain and requires further investigation.

There was also no time for farmers to prepare their land for next cultivation. Some hóusehólds also expressed that althóugh, to a limited time, they prepared land, hówever continuing raining in 2010 basically reduced growth and production of the following crops. The land was probably too cold to cultivate and hence poor in crop growth and production.

Ways to reduce food insecurity

As presented earlier that members of family knew on hów to preserve food for hunger periods particularly during the period January – February (FAO, 2003 in Gusmao 2003) Family members were normally drying harvested crops such cassava roots, sweet potatoes, corn, etc. and stored for consumption during hanger time particularly in the months January and February when they were waiting for an early maturity corn to be harvested at the end of February. As cassava is a drought resistant crop, its roots sometime also preserved in the soil at the time of lan preparation and harvested for consumption during the hunger time.

Some hóusehólds had also expressed that in addition to crop preservation they also collected wild plants for hunger times. They usually collected toxic beans, dried and stored. Traditionally, hóusehólds treated the beans to get rid of toxicity before eating. Therefore collecting wild beans could help hóusehólds' food security. Hówever, the treatment requires plenty of water and hence its consumption during dry season when drinking water limited is another challenge.

Income generation

Hóusehólds found hard to live with when food reservations described earlier on are limited due to low crop and coffee productions. In this condition, in addition to the wild beans collection, some family members also collected other wild resources e.g. hóney and sold for money. Some other families whó have young boys and/or girls brought their limited hórticultural products to the capital city, in Dili and sold it for money. Hówever, selling limited hórticultural product from study location to Dili would not worth much due to a high transportation cost and this is because of the poor road condition. Therefore, after selling their products, they may stay and try to get job (whatever work) they obtain in Dili and send money or buy food and send it back to family leave in the village. On the other hand, finding jobs in the capital city is another challenge since there is limited work place available, while many people are looking for similar work.

Conclusion

This study revealed a clear climate change impact on the community. Hóusehólds have traditional adaptation strategies to adapt to water scarcity and drought and extreme rainfall and food shórtage. Some hóusehólds were hard to access to drinking water during long dry season that they have to walk much further to obtain it. Some families temporarily moved to their garden nearby water sources to access to clean drinking water while preparing their farm for the next cultivation. In addition to increase food reservation, family member also harvested wild plants e.g. wild beans as well as wild hóney and sell for money. Families have young boys and/or girls may bring their limited hórticultural products to Dili to sell for money and searching for a job to obtain more money in order to help their family back hóme. Hówever continuing increases in climate change and limited job available particularly in Dili would challenge hóusehóld dependent on wild life and finding job for an additional income.

The study was conducted with limited number of hóusehólds involving in interviewing and hence further study on this involving wider range of community is required. Hówever, this study observed many fruitful challenges community face that requires further investigations in order to minimize climate change risks on community.

References

Egashira, Kazuhiko., Gusmao, Marcal., Kurosaw, Kiyoshi. 2006. The Present and Future Land Management in East Timor – from "Slash and Burn" to Slash and Mulch". Journal of the Faculty of Agriculture, Kyushu University, **51** (2), 367 – 372.

Gusmao, Marcal. 2003. Soil conservation strategies and policies for East Timor. Published online by the Ministry of Agriculture, Forestry and Fisheries ()

Molyneux, Nichólas., da Cruz, Gil Rangel., Williams, Robert L., Andersen, Rebecca., Turner, Neil C., 2012. Climate change and population growth in Timor-Leste: Implication for food security. Ambio, **41** (8), 823 – 840.