Annual Research Report
2015

Seeds of Life
Fini ba Moris

'Improved food security through increased productivity of major food crops'

Seeds of Life (Fini ba Moris) is a program within the Timor-Leste (East Timor) Ministry of Agriculture and Fisheries (MAF). The Governments of Timor-Leste and Australia collaboratively fund the program. Australian funding is through the Australian Department of Foreign Affairs and Trade (DFAT) plus the Australian Centre for International Agricultural Research (ACIAR) and is managed by ACIAR. The Centre for Plant Genetics and Breeding (PGB) within The University of Western Australia (UWA) coordinates the Australian funded activities.

Table of Contents

List of tables and figures

Tables

Figures

Foreword

This is the tenth Annual Research Report published by the Seeds of Life (SoL) program within the Ministry of Agriculture and Fisheries (MAF). It contains a brief summary of component activities and outputs for year including the 2014-2015 wet season and into 2016. During this period, apart from the research component, improvements were made to the source seed and certified seed multiplication program, the community and commercial seed multiplication and distribution program, monitoring and evaluation, gender in agriculture and the overall national seed system. Three Masters degree graduates assisted through SoL also returned to Dili durng the year to work within the Ministry. This capacity building, along with a large number of short course courses strengthened the MAF to develop and apply agricultural innovations in the future.

Releasing seven new food crop varieties was the highlight of this year's achievements. In April, 2016, on behalf of the MAF, I had the pleasure of releasing two new mung bean varieties, two kidney beans, two sweet potatoes and one new rice variety. This is the first time mungbean and kidney bean varieties have been released for national production in Timor-Leste. In addition, the release of a purple fleshed and a yellow fleshed sweet potato will further improve the nutritional status of Timorese consumers. Yellow varieties possess high concentrations of vitamen A and purple plant material is reported to possess anti-oxidants.

As in the past, all seven variety releases passed through a rigorous evaluation process by comparing the varieties with other local and imported material. First, replicated trials were conducted on research stations. The best of these were then grown on farmers fields under farmer conditions and finally a range of consumers sampled the product for palatability. The final result is that these released varieties were selected from the best of material available world wide. Sufficient high quality seed and planting material of all varieties is now available for multiplication on a commercial scale.

The Seeds of Life program within MAF will cease operating at the end of June, 2016. However its legacy within the MAF ranging from improved infrastructure to a greatly expanded seed system encompasing disciplines from research through to adoption will endure into the future. As a result of nearly 16 years of investment, the MAF has improved capacity to further develop and improve this important agricultural sector.

I would like to acknowledge the Australian Government through the Department of Foreign Affairs and Trade, the Australian Centre for International Agricultural Research and the University of Western Australia for funding and other assistance provided to SoL. This collaboration will have long term effects in the development of agriculture in Timor-Leste to eradicate hunger, food insecurity, and poverty.

June, 2016

Estanislau da Conceição Aleixo Maria da Silva
Minister of Agriculture and Fisheries
Republic Democratic of Timor-Leste

Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ALGIS	Agricultural Land Geographical Information System
AEZ	Agricultural Ecological Zone
ANOVA	Analysis of variance
ATCFC	Australian Tropical Crop and Forages Collection
CCT	Cooperative Café Timor
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Centre
CIP	International Potato Centre
CSPG	Community Seed Production Group
DFAT	Australian Department of Foreign Affairs and Trade
FAO	Food and Agriculture Organization
GIS	Geographic Information Systems
ICRISAT	International Centre for Research in the Semi-Arid Tropics
ILETRI	Indonesian Legumes and Tuber Crops Research Institute
IRRI	International Rice Research Institute
M&E	Monitoring and Evaluation
MAF	Ministry of Agriculture and Fisheries
masl	Metres above sea level
NDA&H	National Directorate for Agriculture and Horticulture (MAF)
NDR&SS	National Directorate of Research and Special Services (MAF)
NDP&P	National Directorate of Policy and Planning (MAF)
NDACD	National Directorate of Agricultural Community Development (MAF)
NGOs	Non-Government Organizations
OFDTs	On-Farm Demonstrations and Trials
PDD	Program Design Document
PGB	Centre for Plant Genetics and Breeding
PSC	Program Steering Committee
QPM	Quality Protein Maize
SEOs	Suco Extension Officer (MAF extension officer)
SoL	Seeds of Life
SoL3	Seeds of Life 3
SOSEK	Social Science and Economics (Sosial Ekonami)
TAG	Technical Advisory Group
TL	Timor-Leste
TLMSP	Timor-Leste Maize Storage Project
UNTL	University of Timor Lorosae
UWA	University of Western Australia

Personnel

Ministry of Agriculture and Fisheries

H.E Estanislao Aleixo da Silva	Minister of Agriculture and Fisheries
H.E Marços da Cruz	Vice Minister of Agriculture and Fisheries
Mr. Deolindo da Silva	Director General for Agriculture
Mr. Amaro Ximenes	National Director of Agriculture, Horticulture and Extension
Dr. Claudino Ninas Nabais	National Director of Research, Statistics and Geographical
Mr. Fernando Soares	Regional Director for Region 1 – East
Mr. Jose Orlando Magno	Regional Director for Region 2 –Central
Mr. Moises Lobato Pereira	Research Manager, Darasula
Ms. Deonisia Raquela Soares Brito	Research Manager, Aileu
Mr. Tobias Monis Vicente	Research Manager, Bobonaro
Mr. Armindo Moises	Research Manager, Ululefa
Mr. Leandro C. R. Pereira	Research Manager, Loes
Mr. Rafael Feliciano	Research Manager, Betano

Name	*District*	*Sub-District*
Ms. Ivonia Maria Soares Magno	Dili	
Ms. Octaviana Ferreira Agostinho	Dili	
Ms. Dorilanda da Costa Lopes	Bobonaro	Maliana
Ms. Maria Fernandes	Dili	
Mr. Cipriano Martins	Aileu	Aileu Villa
Mr. Salvador de Jesus	Aileu	Remexio, Liquidoe, Laulara
Ms. Odete Ximenes	Dili	
Ms. Juliana de Jesus Maia	Manufahi	Same
Mr. Antonio Pereira do Rego	Baucau	Venilale
Mr. Rojino Da Cunha	Baucau	Baucau Villa
Mr. João Bosco Pedro C.R. Belo	Baucau	Baucau Villa
Mr. Basilio da Silva Pires	Baucau	Baucau Villa, Laga, Venilale,
Mr. Março Vidal Corréia	Manufahi	Same
Mr. Felisberto Amaral Soares	Manufahi	Same
Mr. Jose da Costa Freygen	Liquiça	Maubara
Mr. Jorge Amaral	Manufahi	Alas
Mr. Mario Tavares Gonçalves	Liquiça	Liquiça Villa
Mr. Luis da Costa Patrocinio	Bobonaro	Balibo
Mr. Paulo Soares	Liquiça	Liquiça Villa
Mr. Mario da Costa	Viqueque	Uatolari
Ms. Maria Martins	Aileu	Aileu Villa
Ms. Isabel Soares Pereira	Dili	
Ms. Julieta Lidia	Dili	
Mr. Luis Fernandes	Baucau	Baucau Villa
Mr. Amandio da Costa Ximenes	Viqueque	Ossu
Mr. Inácio Sávio Pereira	Viqueque	Viqueque Villa
Mr. Apolinário Ximenes	Ainaro	Maubisse
Mr. Modesto Lopes	Dili	
Mr. Luis de Almeida	Dili	
Mr. Simão Margono Belo	Dili	
Mr. Luis Pereira	Dili	
Mr. Laurentino Ximenes	Dili	
Mr. Sabilio dos Santos	Dili	

Mrs. Maria Lucia de C.R. Seixas	Dili	
Mr. Leão Mauleto	Bobonaro	Maliana
Mr. Florindo Morais Neto	Dili	
Mr. Moises Sarmento	Viqueque	
Mr. Constantino da Costa	Baucau	
Mr. Luis Siki	Bobonaro	
Ms. Nelia Aniceto	Liquiça	
Mr. Andre Alves	Manufahi	
Mr. Feliciano Soares	Viqueque	
Mr. Antonio de Jesus	Aileu	
Mr. Pedro da Costa de Jesus	Baucau	
Mr. Orlando dos Santos da Lux	Ainaro	
Mr. Floriano de Fatima dos Santos	Manufahi	
Mr. Marcelino Santos Lopes	Bobonaro	
Mr. Silvester Sarmento	Liquiça	
Mr. Agostinho Alves	Manufahi	

University of Western Australia

Dr. Harry Nesbitt. Australian Program Coordinator, Seeds of Life
Dr. William Erskine, Director, Centre for Genetics and Plant Breeding

Seeds of Life Office in MAF, Timor-Leste

Mr. John Bruce Dalton	Australian Team Leader
Mr. Robert Williams	Research Advisor
Dr. Asep Setiawan	Source Seed and Quality Control Advisor
Mr. Buddhi Kunwar	Community and Commercial Seed Production Advisor
Mr. Luc Spyckerelle	M&E SOSEK Advisor
Mr. Samuel Bacon	Cropping Systems Advisor
Dr. Buenafe Abdon	Program Assistant
Mr. Martin Browne	Regional Advisor Eastern Region
Mr. Brian Monaghan	Regional Advisor Central Region
Mr. Wayan Tambun	Regional Advisor Western Region
Mrs. Carla Da Silva	Office Manager
Ms. Julieta Borges	Finance Officer
Ms. Cecilia da Silva Pires	Finance Officer
Mr. Aquiles T. Maia Barros	Translator / Interpreter
Ms. Miguelina Ribeiro Garcia	Admin Finance Officer Eastern Region
Mr. Paulino Mendonça	Logistics Manager
Mr. Filomeno Cardoso	Logistics Officer
Mr. Jonas Amaral	IT Officer (until April 2016)
Mr. Marcos Moy	Logistics Assistant
Ms. Elisabeth Belo	Administrative Officer
Mr. Anibal da Costa	Training Coordinator
Mr. Jose Ximenes	IT Officer
Ms. Liliana da Costa Cruz	Admin Finance Officer Western Region
Mr. Egas Vong	Finance Assistant
Mrs. Alexandra Leite Araujo	Administrative Officer
Mrs. Yane Pinto	Admin Finance Officer Central Region
Mr. Edmundus Fahik	Math Teacher
Mr. Felisberto de Jesus Ximenes	Communications coordinator

Overview of the Seeds of Life program

Introduction

Seeds of Life (SoL) is a program within the Ministry of Agriculture and Fisheries (MAF) which assists the identification of productive varieties suited to local conditions, the development of a national seed system, multiplication of planting material of improved varieties to feed into the system and strengthening of the institutional capacity for the seed system to become self-sustaining in the future. The vision of the program is to "have the foundations of a national seed system for Timor-Leste established, capable of providing a high level of access to seed of improved varieties to farmers throughout the country".

The range of crops included in the National Seed System has increased with the release of seven new varieties in April 2016. The recently released varieties include the new crops of mung beans, kidney beans (climbing type) as well as new varieties of rice and sweet potato.

This is the tenth and final Annual Research Report prepared by Seeds of Life. This report provides a program summary, and combines the variety release documents of the seven new varieties that were released in April 2016.

Program summary

This summary follows the outline of the Seeds of Life Program Design Document (PDD) which is designed with four components possessing specific activities for each. These are 1) Crop identification and development, 2) Source seed and quality control, 3) Community and commercial seed development and 4) Seed system management. Capacity building is an integral part of the program and is part of each component. The activities and progress of each component for 2014-2015 are presented below.

Over the reporting period, SoL personnel published 5 refereed papers in scientific journals. In April 2016, the program organized an ACIAR-supported international conference on "Food security in Timor-Leste through crop production" at which 21 papers were presented. These will be published as an ACIAR Monograph before the end of June, 2016. At the conference there were also 56 posters displayed as well as 13 municipal seed system stands and partner organizations stands.

SoL activities received considerable publicity during the year both on local and international TV in addition to publicity in local press and some community radio.

Component 1: Crop identification and development

Component objective: Improved varieties of food crops evaluated and released.
Activities in this component include:

- National agricultural research centres and research stations established
- Genetic material of potential improved varieties identified and sourced
- Potential new varieties evaluated on-station
- Potential new varieties evaluated on-farm
- Selected new varieties officially release

The crop identification and development component, often termed the "research component", evaluates the suitability of introduced and local varieties under the various weather and soil conditions of Timor-Leste. Any entries deemed to be agronomically superior to currently grown varieties are further evaluated by farmers and other consumers before being made available to farmers as "MAF released" varieties. Other agronomic research may then be conducted to improve cropping systems, soils, plant and protection recommendations to further improve farm productivity in the country. The component operated for most of

2015 within the National Directorate of Research and Special Services, which after the reorganisation of the ministry became the National Directorate of Research, Statistics and Geographical Information.

The research component is now fully funded by MAF, except for the training activities which are still funded by Seeds of Life. For 2015, MAF allocated US$300,000 in support of the seed research activities.

Establishment of agricultural research centres and stations completed

The two research centres (Loes and Betano) and the four research stations (Quintal Portugal, Ululefa, Darasula and Raimaten) are active and fully funded by MAF. All major construction at these locations was completed during the first three years of the program and stations.

The research locations are staffed by a total of 77 staff (Table 1), all funded by MAF.

Table 1. Staffing at the research centres and research stations

Research centres and stations	*Researchers*		*Permanent labourers*		*Others*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
RC Loes	2		9	1		
RC Betano	3		15	2	4	
RS Quintal		1	3		4	1
RS Ululefa	1		3			
RS Darasula	3		5		12	4
RS Raimaten	1		3			
Total	10	1	38	3	20	5
	11		41		25	

Genetic material of potential improved varieties identified and sourced

No new genetic material has been imported in 2015, but in 2016 MAF intends to introduce 30 large seeded bean varieties and a range of potato varieties for testing.

On-station trials

During the 2014-2015 wet season, 39 on-station trials, or replicated trials are conducted. These are conducted for ten crops (ranging from one to seven trials per crop). The details on the crops, types and locations of the wet season trials are given in Table 2.

Table 2. Wet season on-station field trials, 2014-2015

Species	*Aileu*	*Baucau*	*Betano*	*Darasula*	*Loes*	*Maliana*	*Maubisse*	*Viqueque*	*# of trials for species*
Cassava	1		1	1	1				4
Maize	1		1	1	1		1		5
Peanut	1		1	1	1				4
Rice, irrigated		1			1	1			3
Rice, upland				2					2
Rice, fertilizer						1			1
Rice, agronomy						1			1
Sweet potato	1		1	1	1		1		5
Potato							2		2
Soy bean			1		1	1	1		4
Wing bean	1		1	1	1				4
Velvet bean			1	1					2
Climbing beans							1		1
Intercropping								1	1
Total	5	1	7	8	7	4	6	1	39

On-farm trials

Across the seven municipalities, a total of 477 OFDTs were established for rice cassava, sweet potato and legumes grown during the wet season of 2014-2015. The details of the OFDTs are provided in Table 3. As in the previous year, no maize OFDTs were done.

Table 3. Established OFDTs by crop and location, 2014-2015 wet season

Municipality	*Rice*	*Cassava*	*Sweet potato*	*Climbing beans*	*Wing beans*	*Mung beans*	*Velvet beans*	*Peanuts*	*Soyabeans*	*Total demplots*
Aileu		16	16	21	21		31			105
Ainaro			5	21	10				2	38
Manufahi			2		10		1			13
Baucau			6		6	2				20
		12	27		14			2		55
	6		8		8		8			38
Liquiça			11			7	7			25
Bobonaro		12	12		8		6			38
	4	15	17	7	7	6	4	10		70
Viqueque		10	16		8		10			44
			17	13	15					45
	10	71	137	62	107	15	67	12	2	477

The selection of new varieties for OFDTs was done in a collaborative manner by all researchers, together with the National Director for Research, Statistics and Geographical Information. The researchers from the research stations presented their findings to the whole research team, and together they selected which varieties to include in the OFDTs for the year.

Of the 477 OFDTs, more than 300 were monitored through the use of mobile phones. Figure 1 shows the locations of OFDTs in five municipalities.

The electronic data submission also makes it easier to analyse the OFDTs by administrative post. One big advantage of the electronic data collection is that, although many researchers collect data separately, the data is automatically collated into one spreadsheet.

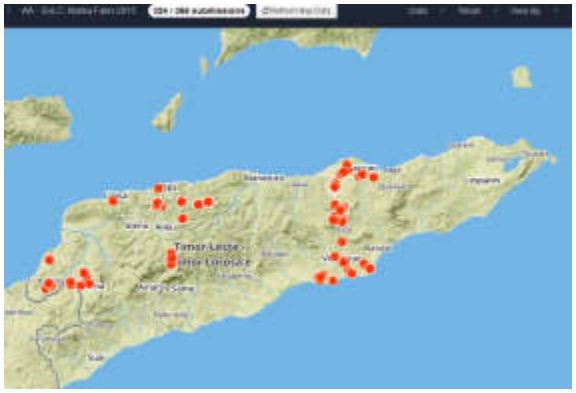


Figure 1. Marked 2014-2015 OFDTs in Bobonaro, Liquica, Aileu, Baucau and Viqueque

Selected new varieties officially released

Seven new varieties were officially released in April 2016 (Table 4). Of the seven varieties one has been selected from local varieties (Sia-LT), and the rest were sourced from the international centres. Yield advantage of the seven varieties range from 29-30% (rice and mung beans) to more than 100% (sweet potato).

Table 4. Summary information of 7 newly released varieties in 2016

Name	*Species*	*Test Name*	*Yield advantage (%)*	*Defining characteristic*
Darasula-CIP	Sweet potato	CIP 83	119	Orange flesh, crumbly flesh when boiled.
SIA-LT	Sweet potato	Local Baucau	110	Deep purple flesh, crumbly flesh when boiled.
Nakroma 1	Rice	M17	29	Shorter season than Nakroma, fragrant
Fleixa-RW	Kidney bean	Mwirasi	54	Purple seed coat.
Ululefa-RW	Kidney bean	RWV 1384	73	Extended flowering allowing 3-4 harvests. Pink seed coat
Lakateu-AV	Mung bean	Merpati	29	Dull seed coat, synchronous flowering, harvest once or twice.
Kiukae-AV	Mung bean	Delta	30	Shiny seed coat, harvest only once

This release of seven varieties include two new species to the range of crops which have been released by MAF since independence. The new species mung bean and two kidney beans. The addition of these 4 legumes to the 18 released varieties will allow farmers to produce more mung and kidney beans using the same area of land. Full details of the released varieties are presented in this report.

Cropping systems research

Crop modelling

As part of the climate change impact research, crop modelling using the APSIM software has continued this year. Modelling is being done for corn variety Sele, to assess the likely impact of climate change at different elevations. Model output yields decline with higher temperatures in the hot coastal areas, but yields increase with higher temperatures in the cool elevated regions, especially with some added fertiliser.

APSIM is also being used to model maize-mucuna (velvet bean) intercropping system in Betano. The maize-mucuna simulation is demonstrating reasonable similarity with field results, i.e. that mucuna has no impact on the yield in the first season, but that the following seasons show substantial increase in yields, similar to field results. APSIM modelling will allow these results to be extended to other locations.

Component 2: Source seed and quality control

Component objective: Sufficient high quality seed being produced to maintain the genetic quality of released varieties.

Activities in this component include:

- Sufficient foundation seed produced for the national seed system
- Sufficient certified seed produced by contract growers
- Quality assurance systems established
- Technical extension support provided to contracted seed growers
- Seed grading, packaging, and storage facilities established
- Formal seed distributied through prefered distribution channels

Like the research component, this is now fully funded by MAF, except for the training activities which are still funded by Seeds of Life. For 2015, MAF allocated US$300,000 in support of the source seed production and quality control activities.

Sufficient foundation seed produced for national seed system

At the end of May 2015, breeder seed and foundation seed of Sele was harvested at the Betano research station. At the Loes research station, about 3,000 m^2 to produce foundation seed of Noi Mutin was established. In September, 200 ears of nucleus seed of Noi Mutin, about 25 kg of Noi Mutin breeder seed and 100 kg of foundation seed was harvested at the Loes Research Station. The breeder seed and foundation seed that was grown in 2015 is given in Table 5.

Table 5. Breeder and foundation seed availability at MAF warehouses, December 2015

Variety	*Production year*	*Breeder seed (kg)*	*Foundation seed (kg)*	*Seed warehouse*
Sele	2015	100	360	Betano RC
Noi Mutin	2015	25	100	Loes RC
Nakroma	2015	20	657	Triloca Baucau

Certified seed produced by contract growers

2014-2015 cropping season

In February 2015, all contracts between MAF National Directorate for Agriculture and Horticulture and the certified seed producers had been signed. In 2015, the seed prices mentioned in the contracts were: 1.25 US $/kg of maize, 1.25 US$/kg of rice, 2 US $/kg of peanut, and 0.05 US$/ stem of cassava. A total area of 42 ha was cultivated with seed crops in the rainy season 2014-2015 (see Table 6). There was no certified seed production in the dry season.

Table 6. Seed crop area in the 2014-2015 season

Municipality	*Maize Sele (ha)*	*Maize Noi Mutin (ha)*	*Rice Nakroma (ha)*	*Peanut Utamua (ha)*
Baucau			5.0	10.0
Bobonaro	5.0			6.0
Manufahi	10.0	3.0		
Viqueque		3.0		
Total	15.0	6.0	5.0	16.0

During the 2014-2015 season, a total of 75 contracts were issued to produce certified seeds (see Table 7).

Table 7. Number of contract growers involved in the 2014-2015 season

Municipality	*Maize Sele*		*Maize Noi Mutin*		*Rice Nakroma*		*Peanut*	
	M	F	M	F	M	F	M	F
Baucau					24	14	20	1
Bobonaro	3	5					2	4
Manufahi	9		7	7				
Viqueque			1	9				
Total	12	5	8	16	24	14	22	5
# of contract	6		24		38		7	
Grand total	75 contracts							

M = male growers. F = female growers

The total certified seed production for 2014-2015 was 5t of rice (Nakroma), 15.2t of maize (8.3t Sele plus 6.9t Noi Mutin) and 10.6t of peanut (Utamua) (Table 8). The targets for production of certified seed of rice, maize and peanut for the 2014-2015 season were 7t, 13t, and 11t respectively.

Table 8. Certified seed production (kg) of Nakroma, Sele, Noi Mutin and Utamua, 2014-2015

Municipality	*Rice (Nakroma)*	*Maize (Sele)*	*Maize (Noi Mutin)*	*Peanut (Utamua)*
Baucau	5,000			7,500
Bobonaro		1,300		3,084
Manufahi		7,000	2,900	
Viqueque			2,000	
Total	5,000	8,300	6,900	10,584

For the tuber crops, in 2015-2016 an estimated 154,000 certified sweet potato cuttings and 128,000 certified cassava cuttings were grown on the research stations of Loes and Betano (Table 9).

Table 9. Estimated sweet potato and cassava production 2015-2016

Site	*Area (m^2)*	*Estimated production (cuttings)*
Sweet potato		
Betano	2,000	15,000
Loes	3,000	140,000
Total		154,000
Cassava		
Loes	6,000	48,000
Betano	10,000	80,000
Total		128,000

Component 3: Community and commercial seed development

Component objective: Mechanisms for the production and distribution of seed through community and market channels strengthened.

Activities in the component include:

- Community Seed Production Groups (CSPGs) established
- Commercial seed producers supported
- Focal seed merchants in local markets established
- Improved access to seed for vulnerable groups
- Systems linking informal seed producers with potential buyers developed

For 2015, MAF allocated US$30,000 for this component.

Community Seed Production Groups

At the start of the 2015-2016 cropping season, no new CSPGs were established. The total number of CSPGs in the 13 municipalities is 1,191 (Table 10). There are CSPGs in 62 of the 65 administrative posts[1]. This total is smaller than the 1,208 CSPGs at the end of 2014, because some CSPGs became CSPs and others are no longer active.

Table 10. CSPGs by crop variety and municipality, 2015-2016

Municipality	*Cropping Season 2015-2016*						*Total # of groups**				
	Maize - Sele	*Maize - Noi Mutin*	*Rice*	*Peanuts*	*Cassava*	*Sweet Potato*	*2015-2016*	*2014-2015*	*2013-2014*	*2012-2013*	*2011-2012*
Aileu	48	16	4	33		5	84	81	99	79	40
Ainaro	57	1	3	11	4	5	71	71	73	84	40
Baucau	66		52	18	1	4	127	127	121	80	40
Bobonaro	25	36	24	22	1	4	108	113	75	80	40
Covalima	12	65	31	35			143	148	58		
Dili	17				1	9	26	26	31		
Ermera	21	22	7	13	3	4	70	72	67	24	
Lautem	56	12	15	48	3	3	133	137	74	24	
Liquiça	32	12	3	10		10	62	62	73	77	40
Manatuto	27		28	18			72	73	77	24	
Manufahi	28	10	6	20	1	5	67	67	65	80	40
Oecussi	27	26		34	4	14	96	99	101	49	
Viqueque	65	20	15	32		1	132	132	104	80	40
Total (2015-2016)	481	220	188	294	18	64	1,191				
Total (2014-2015)	483	224	193	299	21	71		1,208			
Total (2013-2014)	397	154	182	247	17	84			1,018		
Total (2012-2013)	239	109	114	173	10	36				681	
Total (2011-2012)	105	0	59	52	25	39					280

* As several CSPGs grow more than one crop, the sum of the CSPGs by crop is often larger than the number of CSPGs in a municipality.

Not included in Table 10 are the 189 CSPGs that have now associated themselves into CSPs. The total membership of the CSPGs at the end of 2015 was 14,670 persons, of whom 31% were women. Eight of the 13 municipalities also have at least a 30% female membership in the CSPGs.

Commercial Seed Producers

A key element of the national seed system is the production of commercial seed by registered Commercial Seed Producers (CSPs). The number of CSPs has increased steadily since 2012 when there were only two CSPs. There were 31 in 2013, 58 by the end of 2014, and 69 by December 2015.

Component 4: Seed system management

Component objective: MAF capacity to manage the national seed system strengthened

Activities in this component include:

- Seed planning and management systems established
- Monitoring and evaluation processes strengthened
- Seed system gender strategy implemented
- Improved-variety technical and promotional materials developed
- Awareness of improved varieties increased through use of mass media
- Environmental and climate change impacts addressed
- Capacity of MAF staff to manage the national seed system enhanced

Strengthening of Municipal Seed Systems

A well-functioning and sustainable national seed system must be underpinned by well-functioning municipal seed systems. This requires that each municipality must have a good understanding of, or can make reasonable estimates of the amounts of seed that could be produced in the municipality, and has sufficient resources to operate the municipal seed system.

In order to help create awareness and understanding of what is involved in this, and to prepare for the inclusion of sufficient support in the 2016 budget to operate municipal seed systems, the program conducted a series of municipal workplanning and budgeting workshops in the first half of the year which explored the following aspects of municipal seed systems:

- An assessment of the cultivated area in the municipality for each type of major food crop;
- An estimate of the total amount of seeds needed to plant these projected cultivated areas;
- An assessment of the municipality's current capacity to meet the local seed requirement through local CSPs and local CSPGs;

Figure 2. Discussions at a Municipal seed system workshop in Manufahi

These planning and budgeting workshops were well appreciated, and helped to create awareness and understanding of what is involved in getting to a functioning municipal seed system. Some doubt was however voiced to what extent the municipalities would be able to follow up on such plans in light of the uncertainties they experience on their budget allocations. There was also some loss of momentum as the announced reorganisation of MAF took longer than expected to be enacted.

Figure 3. Meeting of the National Seed Council

When the national seed policy was developed in 2012-2013, it was endorsed by the then minister on 11 March 2013. To elevate the status of the seed policy, and to make it indeed a national policy, it was proposed to seek endorsement of the policy by the Council of Ministers. To prepare for this, work has started on a revision of the 2013 policy document, to bring it up to date with the developments that have occurred since (such as the establishment of the National Seed Council; clearer definition of the roles and responsibilities of the municipal MAF offices in the implementation of the municipal seed systems; the emergence of CSPs and their registration by MAF; the associations of seed producers and agricultural shops; etc). It is planned that the updated seed policy will be ready for submission to the Council of Ministers before the end of April 2016.

The updated seed policy will also be more specific on how best to strengthen and integrate farmers' traditional seed systems and community seedbanking into the national seed system. In support for this, and in collaboration with NGOs USC-Canada and RAEBIA, the international Seed Policy Advisor, Pratap Shrestha, provided some inputs in December 2015. Once developed and operating effectively, the traditional seed system can be included in participatory community development and land use planning processes that are foundational elements of such programs as: ACIAR's upcoming farming systems research project, Australian Aid's TOMAK, the World Bank's SAPIP, the EU's pipeline project and other agriculture and rural development projects due to begin implementation in 2016.

At the first Program Management Team meeting after the appointment of the Regional, National and Municipal Directors of MAF, in early December 2015, all of them were given an information folder with key documents relating to the National and Municipal Seed System. Since nearly half of the municipal directors were new in their positions it was felt that this would help to bring them more quickly up-to-date on the latest developments.

Rainfall

Introduction

Rainfall data has been collected at 22 sites at agricultural research stations and other significant agricultural sites during 2013-2014. These sites cover all Agro-Ecological Zones (AEZs). However, due to the mountainous terrain and tropical monsoon climate there is still great variation from one site to another within an AEZ when considering one year of rainfall. Attention should be paid to the actual location of the rain gauge and, in particular, its altitude when using the data for other locations within an AEZ. The location of the eight sites by latitude and longitude with altitude are presented in Table 11.

.

Table 11. Location, altitude and agro-ecological zones of weather stations

AEZ	*District*	*Station name*	*Latitude*	*Longitude*	*Alt (m)*	*Portuguese annual rainfall*	*Rainfall 2014/15*	*Temp. average Max (°C)*	*Temp. average Min (°C)*
1	Liquica	Loes	-8.7372	125.1395	22	937	1066	31.8	25.4
2	Bobonaro	Ritabou	-8.9471	125.2053	163	2053	1622	33.6	20.9
3	Aileu	Quintal Portugal	-8.7045	125.5648	980	1725	1284	28.0	14.7
3	Baucau	Darasula	-8.5351	126.3465	690	1119	1482	28.9	17.7
4	Ainaro	Ululefa	-8.8369	125.6124	1316	1414	1351	23.3	16.5
5	Lautem	Fuiloro	-8.4958	127.0271	358	1906	920	28.7	20.3
6	Manufahi	Betano	-9.1630	125.7185	9	1328	759	31.5	22.1
6	Viqueque	Viqueque	-8.8673	126.3651	50	1617	1145	32.0	21.9

Weather station data is shown for each AEZ with AEZ 3 and 6 having data for two locations. During 2014 - 2015, some areas such as Liquica and Baucau received above average rainfall whereas other areas such as Bobonaro, Aileu, Ainaro, Lautem, Betano and Viqueque received lower rainfall when compared to the long term average during the Portuguese era. The northern AEZs received more rainfall overall than the southern AEZs. The mean annual rainfall for these eight sites (1280mm) was significantly lower than the long term average (1512mm) however the distribution of this rainfall was more contracted in the wet season. The wet season started later in 2014 with average monthly rainfall of only 47mm compared to 116mm for the long term average for the month of November. There was also less rainfall later in the wet season in the months of May and July (Figure 4).

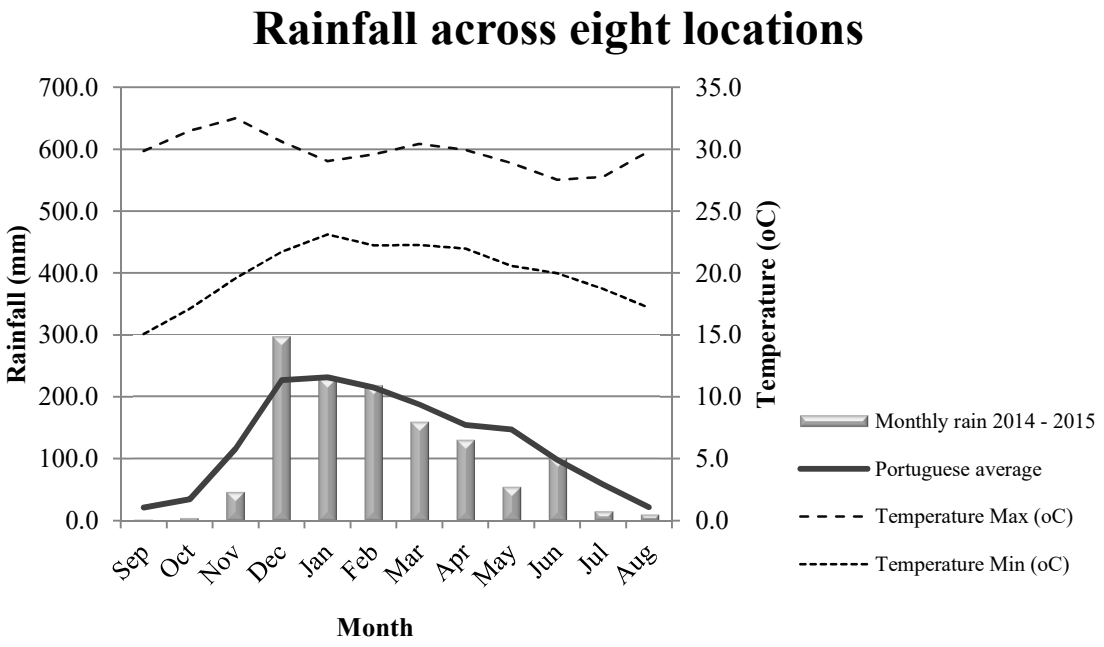
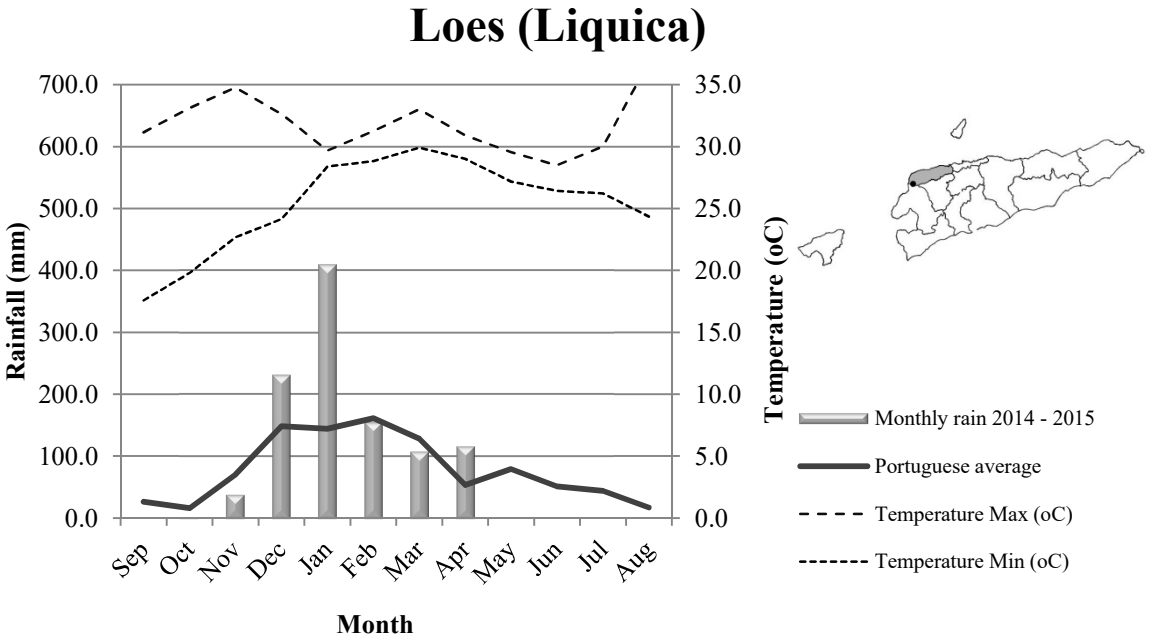


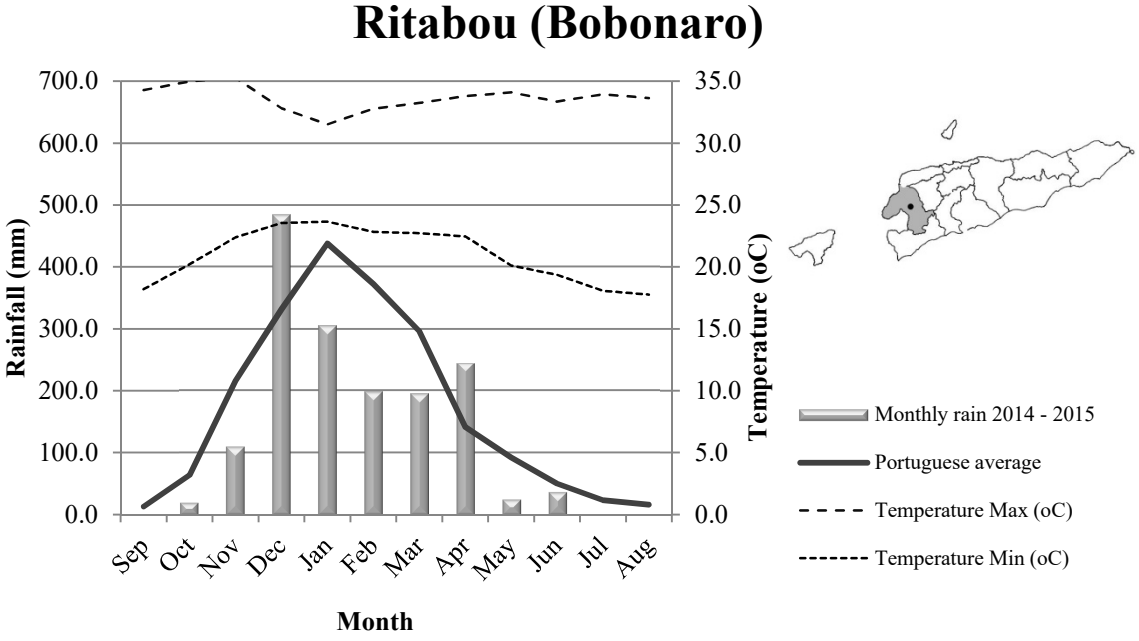
Figure 4. Comparison of average rainfall (8 sites) with long term average.

Rainfall data at select sites

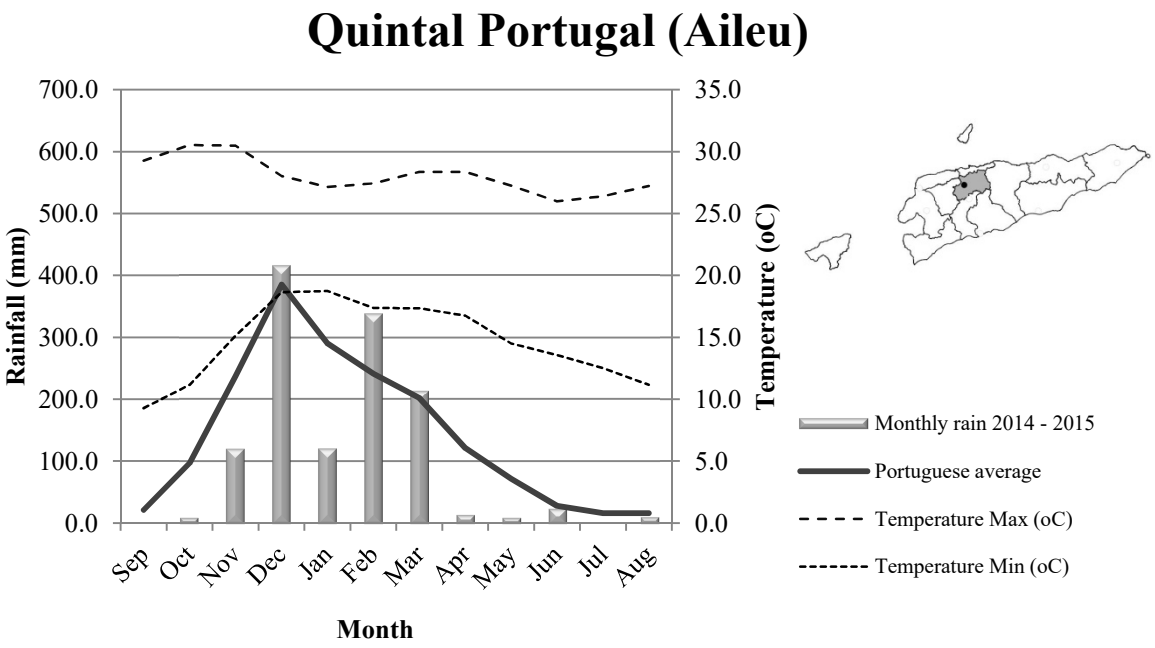
At the north coast research station of Loes, the wet season started later than normal with above average rainfall in December and Januray and a very early end to the wet season. Most of the rainfall in January was received in the last 10-day period with 2 days of over 120mm during this time.



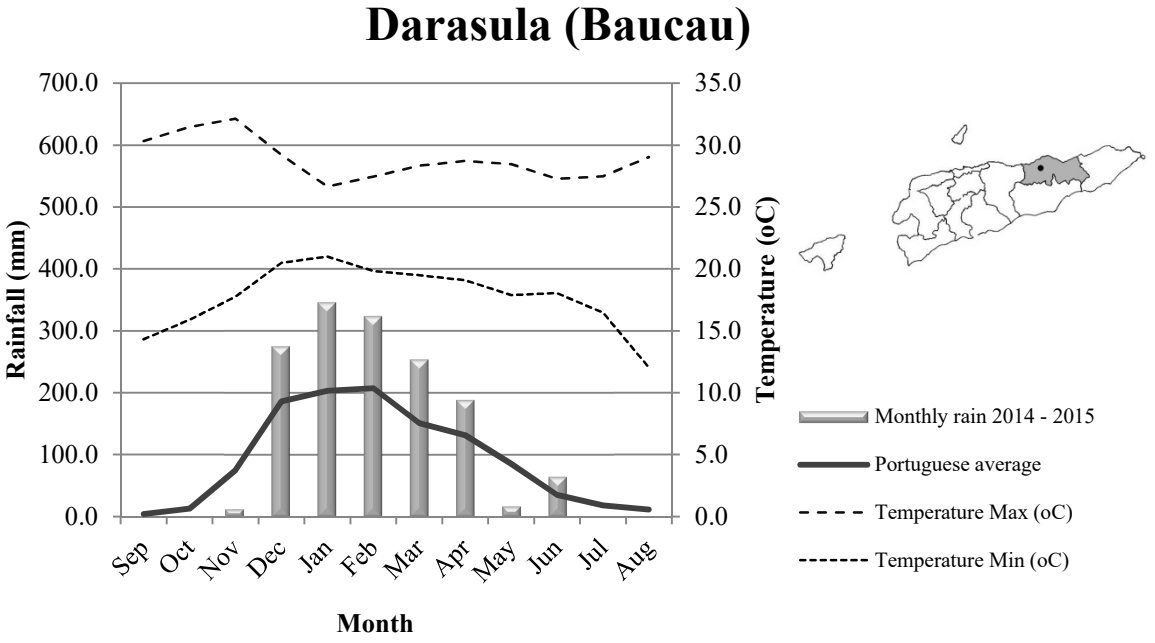
Further up the Loes River in the Maliana Basin, farmer's experienced very high rainfall of nearly 500mm in December to start the wet season. a strong, early start to the wet season. This was followed by sufficient but below average rainfall and an early end to the wet season.



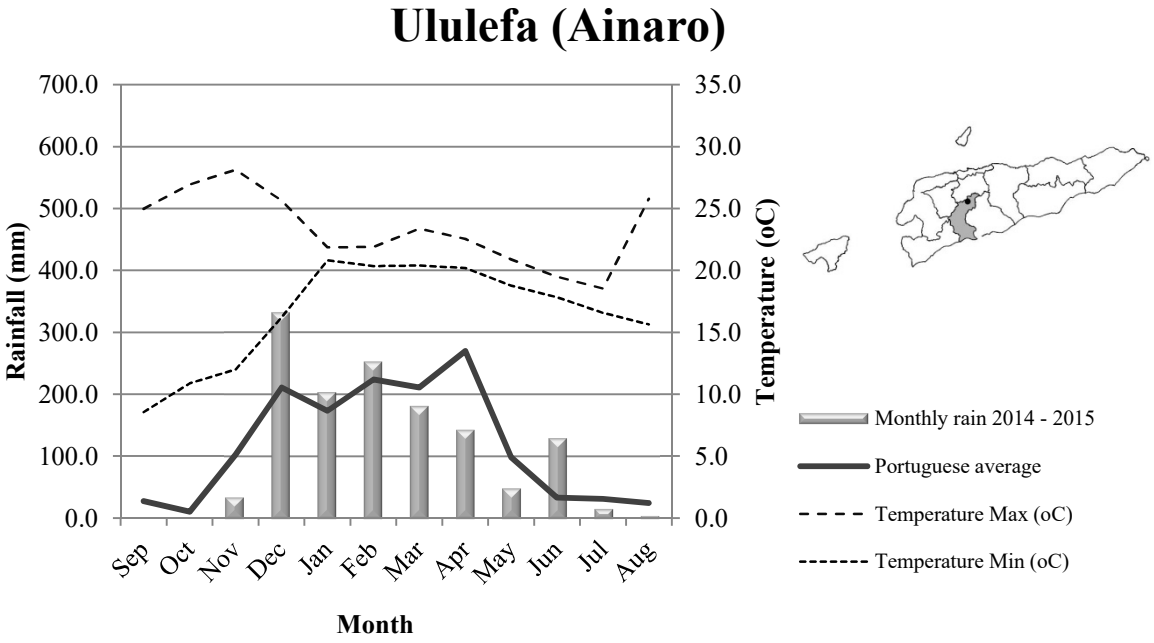
In the mountains of Aileu there was also a late start to the wet season with good rainfalls in December. During January the rainfall was much lower than average. The rains then finished early with very little rainfall received after March. The Maliana plains often have very high temperatures compared to other locations in the country. During this period the maximum temperatures were recorded at 38.4oC during November, 2014.



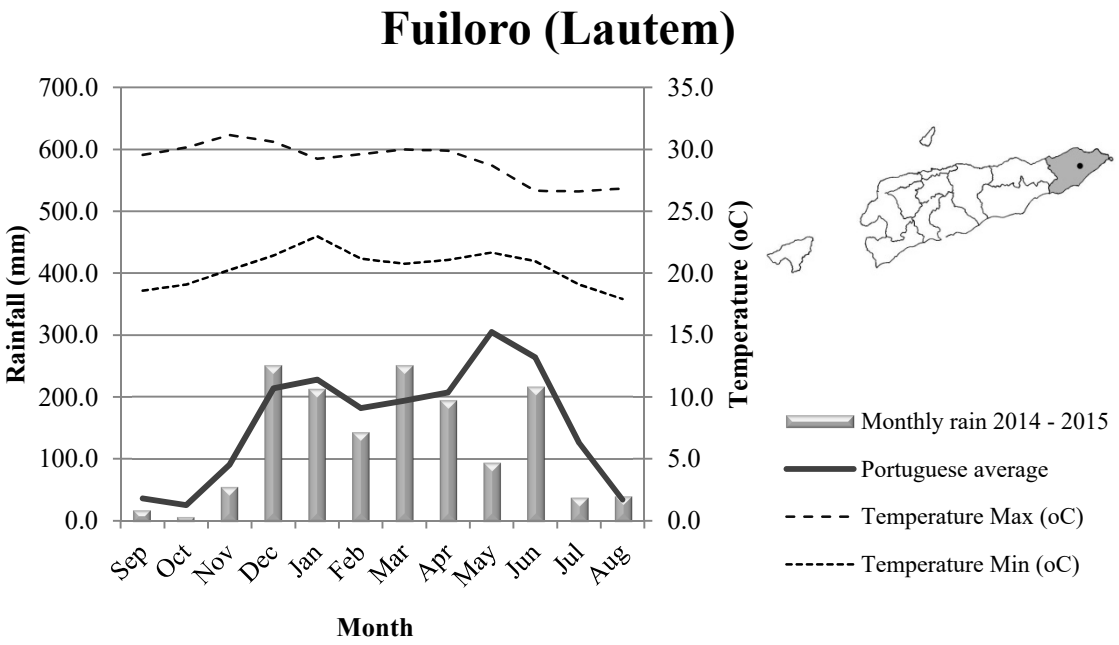
In Darasula, on the Baucau plateau, there was also a late start to the wet season. From December to April the area received good, consistent rainfall which was well above average. The wet season came to an early end in April with a brief rain event of 60mm received during the first two days of June.



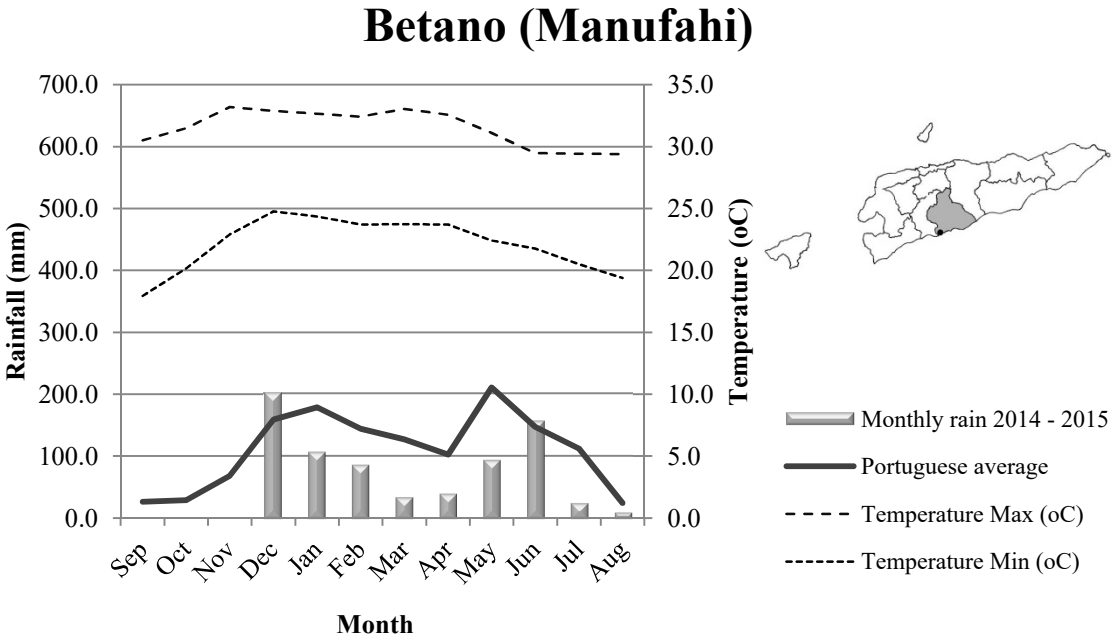
At the high altitude sight of Ululefa, the wet season started later than usual. Good rains were received from December to April, then lower than average rainfall in May with a few showers in June. This site also received the lowest temperatures of the 8 sites with an unusual low of 3.8oC in September, 2014.



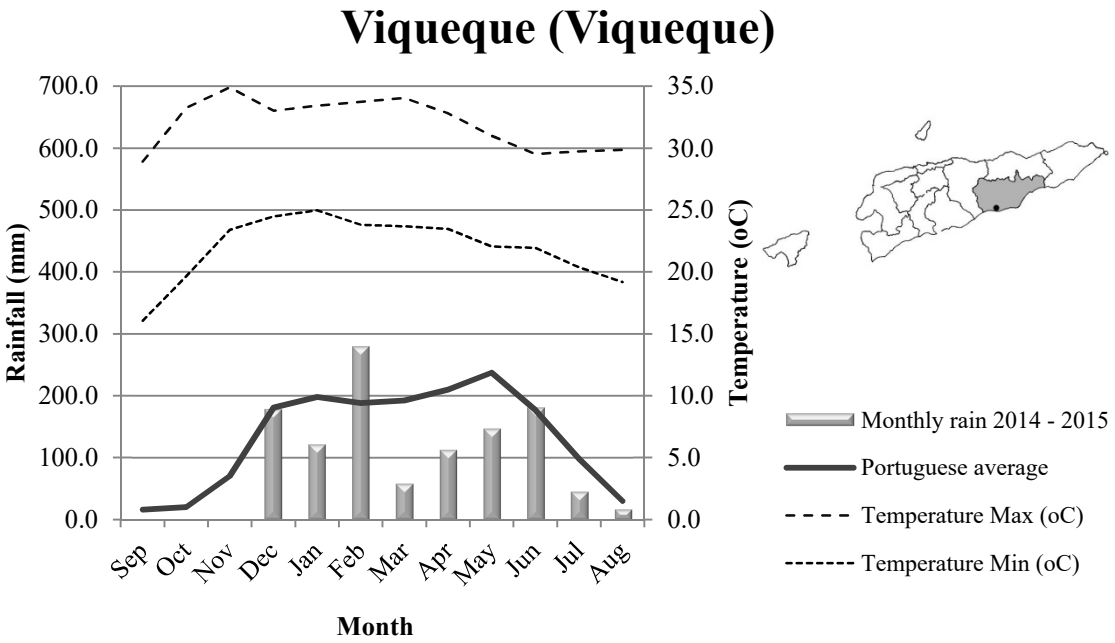
On the eastern Los Palos basin good rains were received throughout the cropping season except for lower than average rainfall in May. This may have caused some difficulty for farmers getting in a second crop. The second season rains then finished earlier with below average rainfall in July. A risk for farmers on the Fuiloro plateau are the high winds that may cause lodging in maize crops. This year gusts were as high as 20.9m/s (75km/hr) in early January.



At the research station on the south coast at Betano, farmers experienced below average rainfall throughout most of the season. The wet season started later and was very low during March and April. The second season rainfall was also low with only the month of June receiving average rainfall. Maximum temperatures are also fairly high along the south coast peaking at 36.4oC in January.



Further east along the south coast, in Viqueque the rain was below average for most of the season. The wet season started late here. After heavy rainfall in February there was a significant decline which may have led to poor grain filling for maize crops. Rainfall was also low during the second season with an earlier finish to rains than historical averages.



Crop varieties released in 2016

On 7 April 2016, the MAF in conjunction with Seeds of Life released seven new food crops for the farmers of Timor Leste.

All of these released varieties have been through extensive testing by researchers and farmers. All the released varieties have been tested on research stations for at least 3 years to release to on-farm testing. Prior to testing on farms, the varieties must demonstrate positive attributes such as high yield, unique eating quality or some unique commercial characteristic. When farmers value the tested varieties, they can be released for on-farm testing.

To release a variety it must be tested for at least 2 years on farms with farmers. Together, researchers and farmers plant, grow and harvest a local variety and the proposed new varieties. The researcher collects data of plant performance (yield, taste et al) as well as records the farmers perception and response.

If after testing, the results were positive, a variety release document was produced, documenting the characteristics, results and implications of releasing the new variety. The variety release committee is composed of representatives of MAF, farmers and civil society. This committee then recommends varieties to be released by the Ministry of Agriculture and Fisheries.

The seven newly released varieties include two kidney bean, two mung bean, one rice and two sweet potato varieties (Table 12).

Table 12. Species, name and source of seven released varieties in 2016

Crop species	Variety	Year	Origin	
Kidney bean (climbing	RWV	2008	Rwanda Agriculture Research Institute	Rwanda
	Mwirasi	2008	Agriculture Research Institute	
Mungbean	Delta	2000	AVRDC (Asian Vegetable Research and Development Centre)	
	Merpati	2000	AVRDC / Indonesia	
Rice	M17	2010	IRRI/Philippines	
Sweet Potato	CIP 83	2005	CIP/Indonesia	
	Local	Local	Timor-Leste	

Detailed information of the recently released varieties are described in the following sections.

Kidney bean (climbing type)

Kidney bean variety release name in Timor-Leste : Fleixa-RW

Botanical name	: Phaseolus vulgaris L.
International name	: Mwirasi
Breeder /Instition	: Rwanda Agriculture Research Institute
Other information	: Released in Rwanda in1987
Evaluation name in Timor Leste	: Mwirasi
Suitable environment	: Elevation > 500m from sea level

Meaning of name

The two climbing type kidney bean varieties have bee named after key locations where these varieties are adapted. Fleixa is an area located at the highest point of the road between Dili and Same, and is an area where many beans are grown. The extension RW indicates that this variety was introduced from Rwanda.

Introduction

Kidney bean (*Phasolus vulgaris* L.) as a legume has an important function for health with the bean containing a protein content of up to 22%, as well as other nutrients (Boughton et al. 2003; Blair et al. 2009). Parts of the plant commonly consumed include the leaves, pods, fresh seeds and dry seeds.

In addition to its function as a source of food for humans, kidney beans also have an important function relating to soil nutrition through nitrogen fixation. It is similar to other legumes that are able to utilise atmospheric nitrogen which happens in the roots through a symbiotic process involving bacteria called *rhizobium*. When the leaves rot and cover the ground it can function as a green manure and also helps in retaining water in the soil and preventing evaporation (Smithson,1990).

Sixteen varieties of kidney bean were introduced from Rwanda and evaluated for adaptation in replicated research station trials. From these results a limited number were selected for further trials on farmer's fields (*On Farm Demonstration Trials*) over seven years from 2009 to 2015. Trials conducted in farmer's fields were based on the farmer's common practice. Usually a farmer plants kidney bean during the rainy season intercropped with maize. The maize stem can be utilised instead of a pole for the bean to climb on. However, kidney bean planted alone during the dry season need a pole to support the vines to climb.

Among the trials implemented, some varieties were removed from the trial due to the lack of characteristics found necessary in the country. Eventually Fleixa-RW variety (Figure 5) was identified as having the best charateristics of the kidney beans tested based on its high yield, adaptation to the climate variations, good taste and farmer preference.

Fleixa-RW originated in Rwanda, Africa. It is a local variety which was not part of an official breeding program. Mwirasi as it is termed there, was promoted through the Rwanda Agriculture Research Institute (ISAR) in 1987. Trials were conducted in various locations of Timor-Leste during the period of 2009-2015. Observation and evaluations made by the researchers showed that Fleixa-RW produced consistent yields and well adapted to the test locations. This variety has a good taste similar to local varieties commonly planted in Timor-Leste.

Figure 5. Seed colour of Fleixa-RW

Yield performance

Replicated trials of the kidney bean varieties were implemented in multiple locations from 2009 to 2015 (Table 14). Through trials and observations, Fleixa-RW was identified as a variety that displayed high consistent yields every trial year with the mean yield in research station was 1.07 t/ha and 2.3 t/ha in farmer's fields. This translales to a yield advantage of 27% and 60% respectively (based on the trial conducted by MAF-SoL).

Fleixa-RW seed is pure seed (not mixed with other varieties as this is a *self-pollinated* variety) and the appropriate planting system was fully controlled by the researchers at research stations. Fleixa-RW has a unique seed colour of light purple and the seed is not too long (short rounded) distinguishing it from other varieties.

Table 13. Description of Fleixa-RW

Characteristics	Fleixa-RW
Seed colour	Purple
Seed type	Flat rounded
Climbing height (m)	2-3
Days to flowering (50 % of flowering)	46
Colour of flower	Purple
Days to harvest (average from all sites in TL)	± 110
Yield on research stations (t/ha)	1.07
Yield on farmer's fields (t/ha)	2.3
Yield advantage above locals on research stations (%)	27
Yield advantage above locals in farmer's fields (%)	60

Table 14. The result of replicated trials compared to other varieties

Variety	Average yield from each period of the trial (t/ha)				Mean yield above locals (%)
	2009-11 (11 sites)	2012-13 (6 sites)	2014 (4 sites)	2009-14	
Ululefa RW	1.02	1.41	1.76	1.40	66
Local Ululefa	*	0.87	1.47	1.17	39
Fleixa RW	0.8	1.08	1.32	1.07	27
Decelaya	0.7	0.92	1.51	1.04	24
Umubano	0.64	1.02	1.30	0.99	17
MAC 28	0.7	0.91	1.18	0.93	10
Gasilidia	0.59	0.88	1.14	0.87	3
YOL X	0.64	0.8	1.14	0.86	2
Local Leber	*	*	0.74	0.74	-12
Local Maubisse	0.42	0.65	1.10	0.72	-14
RWV 2409	0.5	0.67	*	0.59	-31

On farm trials

The results of trials in farmer's fields over two years confirmed that Fleixa-RW variety consistently showed good performance in relation to the yield (Table 15). Statistical analysis showed that Fleixa-RW yielded significantly higher compared to local Ululefa with 60% yield advantage above the local variety.

Table 15. Kidney bean OFDT yield trials (Fleixa-RW) 2013-2014.

Variety	Yield (t/ha)		Mean yield (t/ha)	Number of trial site	Yield advantage above locals (%)
	2013	2014			
L. Ululefa	1.2	1.6	1.4	161	
Fleixa RW	2.3	2.2	2.3	134	60
Ululefa RW	2.5	2.6	2.5	148	78
F.prob (5 %)	<.001	<.001			
LSD	0.6	0.4			
CV (%)	63.1	58.5			

Agronomic adaptability

These legumes are normally planted in temperate zones and sub tropical areas. There are more than 1,000 varieties of legume with various characteristics from short plants of 30cm up to 3m in length. In general, these varieties are not tolerant to cold conditions as with temperatures below 10°C because it can inhibit the germination process and also overall growth. Generally, kidney beans grow best when planted in clay soils with good moisture. Suitable soil pH is neutral to alkaline. During growth kidney beans need adequate water and maximum sun light (not suitable for planting in the shade). The days to maturity of Fleixa-RW is similar to local varieties planted in Timor-Leste.

Disease and insect pest reaction

Observations made during the trial indicate that Fleixa-RW has disease and pest/insect resistance similar to existing varieties used for many years in Timor-Leste.

Impacts:

Economic benefits

Farmers in Timor-Leste normally plant kidney bean for household consumption and sell the surplus yield for family needs. In Timor-Leste observation showed that kidney bean provides good income to the farmers due to it being considered an important crop and with high demand. Many people in Timor-Leste like to consume

kidney bean however the production was low and the price high. Additional new varieties with good characteristic like Fleixa-RW will help farmers to increase their production and income.

Social benefits

Fleixa-RW will provide an alternative planting material for farmers in Timor-Leste to diversify their planting options. Higher yields from Fleixa-RW could result in greater surpluses which could be sold to generate cash and contribute to greater food security in the country.

Environmental impact

Fleixa-RW originated from Rwanda. It was collected as a land race and is not a genetically modified organism (GMO) or bred using recombinant DNA technology. Fleixa-RW will increase the diversity of the current genetic pool in Timor-Leste.

Kidney bean variety release name in Timor-Leste : Ululefa-RW

Botanical name	: *Phaseolus vulgaris* L.
International name	: RWV 1348
Breeder/Institute	: CIAT/ Rwanda Agriculture Research Institute
Other information	: Released in Rwanda in 1987
Evaluation name in Timor Leste	: RWV 1348
Suitable environment	: Elevation > 500m above sea level

Meaning of name

The two climbing type kidney bean varieties have bee named after key locations where these varieties are adapted. Ululefa is the location of the high altitude testing location. Much of the research and seed production was conducted at this site. The extension RW indicates that this variety was introduced from Rwanda.

Introduction

Ululefa-RW variety originated in Rwanda, Africa and was bred at the Rwanda Agricultre Board (RAB) . (Table 16). Testing and observation of Ululefa-RW variety was carried out through replicated trials in various location of Timor Leste in 2009-2015. Observation and evaluations made by the researchers showed that Ululefa-RW displayed consistent yields and well adapted to the test locations. This variety has a good taste similar to local varieties commonly planted in Timor-Leste.

Table 16. Description of Ululefa-RW variety

Characteristics	Ululefa-RW
Type /seed colour	Small/pink
Climbing height based on trial in Rwanda (m)	2
Climbing height based on trial in TL (m)	2-3
Days to flowering (50% flowering)	53
Flower colour	White
Days to harvest (in Rwanda-Africa)	110
Days to harvest (average from all sites in TL)	± 122
Yield based on trial in Rwanda-Africa (t/ha)	3.8
Yield based on trial from MAF/SoL in research station (t/ha)	1.4
Yield based on trial from MAF/SoL in farmer's field (t/ha)	2.5
Yield advantage above locals from replicated trial in research station (%)	66
Yield advantage above locals in farmer's field (%)	78

Figure 6. Colour of maturing Ululefa-RW seed pod

Figure 7. Colour change of maturing Ululefa-RW seed pods

Figure 8. Seed of Ululefa-RW

Yield performance

Various replicated trials were implemented in multiple locations from 2009 to 2015. The result of testing and further observations showed that Ululefa-RW variety was consistent in yield every year with the average yield in the research stations being 1.4 t/ha and in the on farm trials 2.5 t/ha. The yield advantage above locals was 66% and 78%, respectively (MAF-SoL trials).

Ululefa-RW seed is pure seed (not mixed with other varieties as this is a *self-pollinated* variety) and the appropriate planting system was fully controlled by the researchers at research stations. Ululefa-RW has a unique colour - at the young stage green colour, at the mature stage pink colour and after drying brown colour. Seeds of Ululefa-RW are small and pink in colour.

Table 17. Kidney bean replicated yield trials (Ululefa) 2009-2014

Variety	Mean yield from each trial period (t/ha)				Mean yield above locals (%)
	2009-11 (11 sites)	2012-13 (6 sites)	2014 (4 sites)	2009-14	
Ululefa RW	1.02	1.41	1.76	1.40	66
Local Ululefa	*	0.87	1.47	1.17	39
Fleixa RW	0.8	1.08	1.32	1.07	27
Decelaya	0.7	0.92	1.51	1.04	24
Umubano	0.64	1.02	1.30	0.99	17
MAC 28	0.7	0.91	1.18	0.93	10
Gasilidia	0.59	0.88	1.14	0.87	3
YOL X	0.64	0.8	1.14	0.86	2
Local Leber	*	*	0.74	0.74	-12
Local Maubisse	0.42	0.65	1.10	0.72	-14
RWV 2409	0.5	0.67	*	0.59	-31

Replicated test in the research station showed that Ululefa-RW variety is consistent in yield performance and also provided good characteistics during the replicated trials. The average yield of Ululefa RW was 1.4 t/ha and the yield advantage above locals was 66% (Table 17). Based on this information Ululefa-RW was recommended for further evaluation on farmer's fields (*multilocations test*).

On farm trials

Trial result of Ululefa-RW in farmer's fields over 2 years showed consistent good yields (Table 18). Statistical analysis showed that Ululefa-RW achieved significantly higher yield compared to local Ululefa with yield advantage 78% above local.

Table 18. Kidney bean OFDT yield trials (Ululefa) 2013-2014

Variety	Yield (t/ha)		Mean yield (t/ha)	Number of trial site	Yield advantage above locals (%)
	2013	2014			
Local	1.2	1.6	1.4	161	
Fleixa RW	2.3	2.2	2.3	134	60
Ululefa RW	2.5	2.6	2.5	148	78
F.prob (5 %)	<.001	<.001			
LSD	0.6	0.4			
CV (%)	63.1	58.5			

Agronomic adaptability

These legumes are normally planted in temperate zones and sub tropical areas. There are more than 1,000 varieties of legume with various characteristics from short plants of 30cm up to 3m in length. In general, they are not tolerant to temperatures below 10°C because it can inhibit the germination process and also the overall growth. Generally, kidney beans grow best when planted in clay soils with good moisture. Suitable soil pH is neutral to alkaline. During growth kidney beans need adequate water and maximum sun light (not suitable for planting in the shade).

Flowering time of Ululefa-RW variety was 2 weeks later than other varieties tested in Timor-Leste and takes 2-3 weeks longer to reach maturity. It was concluded that as the growth duration of Ululefa-RW was longer than other varieties this would increase threat of pest and disease damage.

Disease and insect pest resistance

Observations made during the trial indicate that Ululefa-RW has disease and pest insect resistance similar to existing varieties used for many years in Timor-Leste. Observation made in Rwanda-Africa showed that Ululefa-RW has tolerance to leaf spot (*angular leaf spot*), rust (*ascochyta blight*), *anthracnose* and *virus mosaic* which normally attack beans.

Impacts:

Economic benefits

Farmers in Timor Leste normally plant kidney bean for household consumption and sell the surplus yield for family needs. In Timor-Leste kidney beans provide good income for farmers as they are in high demand. Many people in Timor-Leste like to consume kidney bean. However the price is high because yields are low. Additional new varieties with good characteristic like Ululefa-RW will help farmers to increase their production and income.

Social benefits

Ululefa-RW will add an extra variety for farmers in Timor-Leste to diversify their planting options and reduce the risks faced by farmer (in the context of limitation of varieties). In addtion to promoting food security within the country and improved nutrition, this variety provides high yield increasing possibilities for income generation.

Environmental impact

Ululefa-RW originated from Rwanda. It is not a genetically modified organism (GMO) bred using recombinant DNA technology. Ululefa-RW will increase the diversity of the current genetic pool in Timor-Leste.

Mung beans

Mung bean released variety name in Timor-Leste : Lakateu-AV

Botanical name	: *Vigna radiata* L.
International name	: VC2754
Breeder /Institution	: AVRDC (Asian Vegetable Research Development Centre)
Other information	: Released in Indonesia as Merpati 1991
Evaluation name in Timor-Leste	: Merpati
Suitable environment	: Area with elevation < 700m above sea level

Meaning of name

The two mung bean varieties are named after native birds of Timor Leste. Lakateu is a turtledove, with the same dull colour as the seed coat of Lakateu-AV.

Introduction

Mungbean is a tropical legume that is very important for good nutrition because it has high protein content of approximately 23% (USDA, 2016).

Timor Leste has the third worst level of stunting in the world (WHO, 2013). Fifty percent of children under age of 5 years old are below normal height (UNICEF, 2013). One of the causes of malnutrition is that the diet is low in protein. To respond to the problem of malnutrition, MAF had identified appropriate varieties that contains a high level of protein. High protein foods are derived from two sources namely legume (vegetable protein) and meat (animal protein). The majority of Timorese consume meat rarely due to expensive price of meat and low-income of population. Additionally, Timor-Leste has not promoted adequate plant nutrients which substitute meat as a source of protein.

To increase mungbean production within the country, farmers need high yielding varieties, adapted to the local climate and environment and based on the consumer's preferences. To achieve this, 8 varieties of mung bean released in Australia and Indonesia were sourced from AVRDC for evaluation in Timor-Leste.

Among these 8 varieties, Lakateu-AV was selected due to the good performance and high yield advantage compared to locals (25% in the research station and 30% on farmer's field). Lakateu-AV matures evenly, meaning there is only a need to harvest once, and maybe twice. Lakateu-AV has a dull seed coat, which is a prized consideration for eating and making mung bean porridge.

Lakateu-AV is a short season mung bean with synchronous flowering (Table 19).

Table 19. Description of variety Lakateu-AV

Plant height at harvest (cm)	57
Days to flowering (days)	35
Flower colour	Cream
Days to harvest (days)	58 days
Maturity	synchronous
Seed colour	Dull seed coat
Seed type	Rounded
Seed weight 100 (gr)	6.0
Yield (t/ha)	1.7
Yield advantage above local (%)	29

Figure 9. Seed of variety Lakateu-AV

Yield performance

Mungbean is a self-pollinated crop hence it does not require long planting distance (Approximately 3 meters between varieties) compared to open pollinated varieties such as maize which need long planting distances (Approximately 200 meters).

Lakateu-AV underwent replicated trials for 6 years in two research station (Betano and Loes). Although this variety was tested only in two locations, it shows good performance and consistent yield when tested over several years (Table 20). The result of trials showed that the average yield of Lakateu-AV was 1.7 t/ha compared to locals 1.2 t/ha with yield advantage 42% above locals.

Table 20. Mungbean (Lakateu – AV) replicated trials yields (t/ha) 2008-2013.

Variety	Betano 2013	Betano 2012	Betano 2011	Betano 2010	Betano 2009	Betano 2008	Loes 2012	Loes 2010	Average	Yield advantage (%)
Lakateu-AV	2.4	1.4	2.3	1.2	0.9	1.4	2.6	1.1	1.7	42
Besicama	1.1	1.1	0.8	0.5	0.5	1.0	2.7	1.5	1.1	8
F. Metan	1.5	0.9	1.3	0.7	0.8	1.4	1.9	1.2	1.2	0
Balibo	1.3	1.2	0.7	0.6	0.5	0.8	1.9	1.3	1.0	-17
Suai	1.1	1.1	1.9	0.6	0.4	1.0	1.9	1.0	1.1	-8
Fprob	0.0003	0.002	<0.001	0.005	<0.001	<0.001	0.01	0.35		
LSD	0.6	0.3	0.5	0.3	0.2	0.4	0.5	ns		

*=not planting, ns= not significant.

Statistical analysis of trials conducted at Betano and Loes showed that Lakateu-AV perform well and consistent over the years. This indicates that Lakateu-AV can be categorized as suitable variety to be evaluated in farmers' fields.

On farm trials

Adaptation tests have been conducted on Lakateu-AV varieties with farmers during 2013 and 2015. Five demonstration plots was established in 2013 at administrative post Balibo and another 10 were established in 2015 in administrative post Viqueque Villa. Total demonstration plot which was established in two years was 15.

On farm trials showed that variety Lakateu-AV consistently performed during the two years of evaluation (Table 21). Lakateu-AV produced more yield than the local varieties in 2013 and 2015 (29% yield advantage).

Table 21. Mungbean (Lakateu) OFDT yields (t/ha) in 2013 and 2015.

Variety	Yield (t/ha)		Average	Yield advantage above locals (%)
	2015	2013		
Lakateu-AV	1.9	1.4	1.6	29
Local	1.5	1.0	1.3	
F.Prob	0.06	0.02		
Lsd	ls	0.34		
CV (%)	16	27		

ns = not significant.

Agronomic adaptability

Lakateu-AV is a variety that showed consistent results during testing. The trial results indicate that Lakateu-AV has better productivity compared to locals when tested in accordance with farmers planting systems. Statistical analysis also showed no interaction between varieties and the environment (Annual Research Report MAF-SoL, 2013). Therefore Lakateu-AV is suitable for cultivation in areas where it was tested.

Disease and insect pest reaction

Lakateu-AV is resistant to leaf spot. The observations made during testing showed that it tested together with local varieties suffered the same attacks of leaf spot from unknown pathogens but Lakateu-AV varieties still provided better results than local.

Herbicide reaction

The majority of farmers in Timor-Leste do not to use herbicides, so the reaction is unknown.

Impacts:

Economic benefits

Mung bean has a huge potential in this country. With 29% yield advantage (without additional inputs) over local variety, Lakateu-AV will provide an alternative option for farmer to increase food production for their own consumption as well as income from surplus production.

Social benefits

Cultivation of Lakateu-AV will provide an alternative planting material for growers in Timor-Leste and will add to the diversity of food availalbe for household which is beneficial for nutrition. Additionally, it can serve as source of protein as an alternative to meat.

Environmental impact

This variety was introduced to Timor Leste in 2008 to test its suitability to the environment as well as to see if it will bring negative impact on the environment during the test period. It is not a genetically modified organism (GMO) or bred using recombinant DNA technology. Lakateu-AV is bred through conventional selection. Lakateu-AV will increase the diversity of the current genetic pool in Timor-Leste.

Mungbean released variety name in Timor-Leste : Kiukae-AV

Botanical name	:	*Vigna radiata* L.
International name	:	VC 1973 A
Breeder /Institution	:	AVRDC (Asian Vegetable Research Development Centre)
Other information	:	Released in Australia (Delta), China (Xu Yin No.1), Thailand (Kamphaengsaen 1) and South Korea (Seonhwanogdu)
Evaluation name in Timor Leste	:	Delta
Suitable environment	:	Area with elevation < 700m above sea leve

Meaning of name

The two mung bean varieties are named after native birds of Timor Leste. Kiukae is the common name for quail, that lives on the ground and suddenly flies away when disturbed. It represents a short mung bean variety that is quick to flower and mature.

Introduction

Kiukae-AV is one of the 8 varieties sourced from AVRDC for evaluation in the country. It was recommended for release due to good performance and high yield advantage over local variety (42% in the research station and 29% on farmer's field). Kiukae-AV matures very evenly, meaning there is only a need to harvest once. Additionally, variety Kiukae-AV was well adapted to the climate, consistent during trials and preferred by farmers. Details of Kiukae-AV is described in Table 22 and Figure 10.

Table 22. Description of variety Kiukae-AV

Plant height at harvest	65
Days to flowering (days)	35 days
Flower colour	Cream
Days to harvest (days)	58 days
Maturity	Very synchronous
Seed colour	Green and Bright
Seed type	Rounded
Seed weight 100 (gr)	4.9
Yield (t/ha)	1.7
Yield advantage above local (%)	30

Figure 10. Seed of variety Kiukae-AV

Yield performance

Variety Kiukae-AV is a self-pollinated crop so it only requires a few meters between varieties during evaluation. It underwent replicated trials for 6 years in two research station (Betano and Loes). Though only tested at two locations,this variety showed good performance and consistent yield when tested over several years (Table 23).

The result of test (see table below) showed that the average yield of variety Kiukae-AV was 1.5 t/ha compared to locals 1.2 t/ha and the yield advantage above locals were 25%.

Table 23. Mungbean (Kiukae) replicated trial results (t/ha) 2008-2013.

	Betano 2013	Betano 2012	Betano 2011	Betano 2010	Betano 2009	Loes 2012	Loes 2010	Average	Yield advantage (%)
Kiukae-AV	1.6	1.7	1.4	0.8	1.1	2.7	1.2	1.5	25
Besicama	1.1	1.1	0.8	0.5	0.5	2.7	1.5	1.1	-8
F. Metan	1.5	0.9	1.3	0.7	0.8	1.9	1.2	1.2	0
Balibo	1.3	1.2	0.7	0.6	0.5	2.4	1.3	1.0	8
Suai	1.1	1.1	1.9	0.6	0.4	2.5	1.0	1.1	0
Fprob	0.0003	0.002	<0.001	0.005	<0.001	0.01	0.35		
LSD	0.6	0.3	0.5	0.3	0.2	0.5	ns		

The result of statistical analysis from many years in the two research stations (Betano and Loes) showed that variety Kiukae-AV performed well and consistent over the years. This data was sufficient to recommend this variety for testing in farmers' fields.

On farm trials

Kiukae-AV was tested with farmers for 2 years, 2013 and 2015. Five demonstration plots was established in 2013 at administrative post Balibo and another 10 was established in 2015 in administractive post Viqueque Villa. Total demonstration plot which was established in two years was 15.

Table 24. Mungbean (Kiukae) OFDT yield (t/ha) results 2013 and 2015.

Variety	Yield (t/ha)		Average	Yield advantage above locals (%)
	2015	2013		
Kiukae-AV	2.0	1.3	1.7	30
Local	1.5	1.0	1.3	
F.Prob	0.06	0.02		
Lsd	ns	0.34		

ns= not significant

On farm trials showed that variety Kiukae-AV consistently produced higher yields than local varieties across the two years. The average yield of variety Kiukae-AV was 1.7 t/ha and local variety was 1.3 t/ha and the yield advantage above locals was 30 % (Table 24).

Agronomic adaptability

Kiukae-AV is adapted to the climate and cropping system in Timor leste. Trial results indicate that variety Kiukae-AV has better productivity compared to locals when tested in accordance with farmers prefered planting system. Kiukae-AV has the large advantage of having very synchronous flowering and maturity. This means that farmers need only to harvest the crop at one time. Local varieties are often harvested 3 times, so the syncronous flowering will significantly reduce the labour needs of Kiukae-AV.

Disease and insect pest reaction

Kiukae-AV is resistant to leaf spot. Observations made during testing showed that Kiukae-AV suffered similar pest reactions from other diseases to local varieties. It is no more susceptible to pests and diseases than the local check varieties.

Herbicide reaction

The majority of farmers in Timor-Leste do not to use herbicides, so the reaction is unknown.

Impacts:

Economic benefits

Kiukae-AV has the potential to incease mung bean production in Timor-Leste. It will provide an alternative option for farmer in Timor-Leste to add to their food consumption and to facilitate farmer to increase crop yield. On the other hand, there is a market opportunity for farmers to sell their mungbean for household income.

Social benefits

Cultivation of Kiukae-AV will provide an alternative planting material for growers in Timor-Leste and will add to the diversity of food for household especially for nutrition. Moreover, it can serve as source of protein. The reduced labour required to harvest Kiukae-AV will increase production while reducing the labour days required.

Environmental impact

Kiukae-AV was introduced in Timor Leste in 2008 to test its suitability. It is not a genetically modified organism (GMO), and was bred using conventional technology. Kiukae-AV will increase the diversity of the current genetic pool in Timor-Leste.

Sweet potato

Sweet potato released variety name in Timor-Leste : Darasula-CIP

Botanical name	: *Ipomea Batatas* L.
International name	: CIP440001
Breeder /Institution	: Centro International da la Papa (CIP)
Other information	: Released in South Carolina USA as Resisto
Evaluation name in Timor Leste	: CIP 83
Suitable Environment	: All of Timor-Leste, from coastal to elevated areas

Meaning of Name

This sweet potato variety is named after one of MAF research station, based in the suco of Darasula, Municipal Baucau. The extension of CIP shows that the sweet potato was sourced from the Centro International da la Papa (CIP).

Introduction

Timorese society considers sweet potato as the third most important food crop, after corn and rice. The tuber can be used as food, leaves as a vegetable and can also be used as feed for animals. Through previous variety evaluation, MAF released three sweet potato varieties namely Hohrae 1, Hohrae 2 and Hohrae 3 in 2007. These varieties continue to provide consistent yield each year.

Since 2007 research has continued to identify new suitable sweet potato varieties. Darasula-CIP has high productivity and well adapted to all areas in Timor Leste. It produces large tubers with light purple skin and orange flesh. This is the second sweet potato released with orange flesh, the first being Hohrae 3. Darasula-CIP is crumbly when boiled making it quite different from Hohare 3 which is quite wet when boiled, a similar texture to pumpkin. Many farmers like with this variety because it tastes good and is sweet. The details of variety Darasula-CIP is described in Table 25 and Figure 11.

Table 25. Description of sweet potato variety Darasula-CIP

Characteristic	Darasula-CIP
Plant type	Semi compact
Source	CIP
Average yield (t/ha)	9.1
Yield advantage above locals (%)	119
Duration from planting to harvest	± 4 Months
Leaf type	Cordate
Immature leaf colour	Green
Predominant colour of vine	Purple mixed with little green
Petiole pigmentation	Purple mixed with little green
Secondary colour of vine	Purple mixed with little green
Abaxial leaf vine pigmentation	Purple
Storage root skin colour	Light purple
Storage root flesh colour	Orange
Eating quality when boiled	Crumbly
Taste	Flavoursome and sweet

Figure 11. Skin and flesh colour of variety Darasula-CIP

Yield performance

Approximately 4-5 trials were conducted every year on variety Darasula-CIP in the research station and research centres from 2010 to 2015. Darasula-CIP produced higher yield than locals (Table 26). During farmer taste tests,Darasula-CIP was one of the favoured varieties due its high yield, large tubers, orange flesh and good eating qualities.

Table 26. Sweet potato (Darasula-CIP) yields (t/ha) from replicated trials 2010 to 2015.

Year	Hohrae 3	Darasula-CIP	Local
2010	9.5	8.6	5.9
2011	10.2	9.1	4.7
2012	14.0	7.9	5.9
2013	9.7	8.3	8.7
2014	5.3	6.8	4.5
2015	1.3	11.9	8.5
Average	8.3	8.8	6.4

Darasula-CIP produced higher yield than local sweet potatoes at all research locations. The locations range from Loes and Betano near sea level to Maubisse above 1100m (Table 27).

Table 27. Sweet potato (Darasula-CIP) yields (t/ha) from replicated trials over 4-8 years.

Location	Hohrae 3	Darasula-CIP	Local	Years
Aileu	9.2	7.8	8.8	6
Baucau	3.7	3.0	0.9	6
Betano	10.1	8.6	6.2	8
Loes	14.4	11.8	6.8	6
Maubisse	12.6	14.1	11.0	4
Mean general	10.0	9.1	6.7	

Farmer's preferences on taste test in the research station

Among the 18 introduced and local varieties used for comparison, the varieties were tested for eating quality. Darasula-CIP was preferred by 88% of farmers in Betano. They chose Darasula-CIP due to the high yield and good eating quality (tasty and crumbly). The other research stations also provided good comments on variety Darasula-CIP.

Adaptation trial on farmer's fields

Darasula-CIP and Hohrae 3 were tested with farmers in their fields in 2014 and 2015. Locations varied from near sea level to more than 1200m elevation. On farmers fields, Darasula-CIP produced more than double the yield of the local check varieties, but not as much as the released variety Hohrae 3(Table 28).

Table 28. Yield (t/ha) of Darasula-CIP in OFDTs 2014 and 2015.

Year	Locations	Darasula-CIP	Hohrae 3	Local
2014	74	10.4	12.0	5.1
2015	90	7.1	9.59	2.9
Average		8.8	10.8	4.0
Yield increase above locals (%)		119	170	-

Farmers involved in this activity want to replant variety Darasula-CIP because of its vigorous growth, large tubers, and good taste. Maturity days are short (only four and half months). The cuttings can be multiplied In locations where water supplies are sufficient.

Agronomic adaptability

Darasula-CIP maintains high yield across a wide range of environments and can be planted in any location,even in high elevation.

Storage of sweet potato tuber and cuttings

Cuttings can be planted in the shade with sufficient water to support growth. Cuttings of this variety, as with other varieties, must stored in the shade. If kept properly, tubers of the variety Darasula-CIP can be stored for up to 3 months.

Disease and insect pest reaction

Like local varieties, tubers of Darasula-CIP is not resistant to sweet potato weevil when left in the ground (cracked soil). It is susceptible to mycoplasma disease which makes the leaves become smaller as well as to leaf scab during wet weather. Prevention of these diseases is by removing infected plants or any plants that show symptoms of the disease. Burning of infected plants will prevent contamination of other plants.

Herbicide reaction

Herbicides are not used on sweet potato in Timor-Leste, so the reaction is unknown. It is recommended to identify in the future if farmers are already using herbicide.

Impacts:

Economic benefits

Variety Darasula-CIP has significant positive impact for farmers. The result of high production with good characteristics can provide more food for farmers. In situations where food is limited, variety Darasula-CIP can help farmers to produce enough food to be consumed by the family.

Farmers who produce a surplus will able to sell in the local market to increase their income. The young leaves could be cooked as vegetable because it contains iron which is good for human health. Root and leaves can also be used as food for animals. There is a possibility to use sweet potato roots for industry in the future.

Social benefits

Cultivation of Darasula-CIP will provide an alternative planting option for subsistence growers in Timor-Leste. The high yield and large tuber should help it contribute to greater food security. Consumption of the orange fleshed Darasula-CIP will increase in-take of vitamin A.

Environmental impact

Darasula-CIP was bred using conventional breeding techniques in Centro International da la Papa (CIP) and it is not a genetically modified organism (GMO). Darasula-CIP will increase the diversity of the current genetic pool in Timor-Leste.

Sweet potato released variety name in Timor-Leste : Sia-LT

Botanical name	: *Ipomea Batatas* L.
International name	: Unknown
Breeder /Institution	: Unknown
Evaluation name in Timor Leste	: Local Baucau
Suitable environment	: All of Timor-Leste, from coastal to elevated areas

Meaning of name

Sia-LT is named after the Makasa'e word for sweet potato, Sia. Makasa'e is the mother tounge of people living in much of the Baucau/Viqueuqe districts. Sia was first identified on farmers fields in the Makasa'e language area. The extension LT indicates that this variety was sourced from farmers fields and was known to them as a local timor variety.

Introduction

Since 2007 research has continued to identify new suitable sweet potato varieties. Among the various varieties tested, was a local variety from Baucau with purple flesh and purple skin that was highly prized by farmers. Farmers selected this variety based on its productivity, short season, taste, nutritional content and unique colour of flesh. Based on this information this local Baucau was released as Sia-LT in order to increase the diversity of sweet potato variety for farmer in the nation.

Sia-LT provides high yield and well adapted to various locations. Sia-LT contains significant levels of anthocyanins which act as antioxidants in the body, protecting cells against toxins in the human body. Many farmers prefer to plant this variety due to the tasty and sweet characteristics (Table 29 and Figure 12).

Table 29. Description of new sweet potato variety Sia-LT

Character	Sia-LT
Plant type	Semi compact
Source	Farmers from Baucau
Mean yield	7.6 t/ha
Yield advantage above locals	110 %
Days to harvest	± 4 Months
Leaf shape	Cordate
Immature leaf colour	Purple mixed with little green
Predominant colour of vine	Green mixed with little purple
Petiole pigmentation	Purple mixed with little green
Secondary colour of vine	Green mixed with little purple
Abaxial leaf vine pigmentation	Green
Abaxial leaf vine pigmentation	Purple
Storage root skin colour	Purple
Boiling quality	Crumbly when boiled
Taste	Tasty and sweet

Figure 12. Flesh colour of variety Sia-LT

Yield performance

Over three years of testing in five locations, Sia-LT generally has a higher yield than local check varieties. Yields of Sia-LT are generally lower than the released variety Hohrae 3 (Table 30).

Table 30. Sweet potato (Sia-LT) yields (t/ha) in replicated trials 2013 to 2015.

Location	Year	Season	Hohrae 3	Sia-LT	Local
Baucau	2013	Wet	1.6	1.3	0.9
Loes	2013	Wet	20.3	11.2	11.2
Maubisse	2013	Wet	5.4	10.3	9.4
Baucau	2014	Wet	1.2	0.7	1
Betano	2014	Wet	1.6	1.6	1.3
Betano	2014	Dry	5.9	16.1	10.4
Loes	2014	Wet	13	5.9	4.8
Maubisse	2014	Wet	5.4	7.4	7
Aileu	2015	Wet	2.4	2.5	3.1
Baucau	2015	Wet	4.1	1.3	1.6
Betano	2015	Wet	5.7	2.7	3
Loes	2015	Wet	14.9	16.4	15.4
Maubisse	2015	Wet	29.5	21.6	19.3
Mean yield (t/ha)			8.5	7.6	6.8

In all three years of testing, Sia-LT and Hohrae 3 produced higher yield than local check variety (Table 31). Although the difference was quite small, Hohrae 3 produced higher yield than Sia-LT in two of the three years.

Table 31. Mean sweet potato (Sia-LT) yields (t/ha) in replicated trials 2013 to 2015.

Year	Hohrae 3	Sia-LT	Local
2013	9.1	7.6	7.2
2014	5.4	6.3	4.9
2015	11.3	8.9	8.5
Mean	8.5	7.6	6.8

Farmer's preferences during taste tests at research stations

Among the 18 varieties, Sia LT was the preferred by 90% of the farmers in Baucau and 78% of farmers in Loes. They chose Sia-LT due to the high yield and good eating quality (tasty and crumbly). The other research stations also provided good comments on variety Sia-LT.

Table 32. Sweet potato (Sia-LT) yield (t/ha) replicated trials, 5 locations over three years.

Location	Hohrae 3	Sia-LT	Local
Aileu	2.4	2.5	3.1
Baucau	2.3	1.1	1.1
Betano	4.4	6.8	4.9
Loes	16.0	11.1	10.5
Maubisse	13.4	13.1	11.9
Mean	8.5	7.6	6.8

Adaptation trial in farmer's field

Sia-LT was tested with farmers at 164 locations during 2014 and 2015. Each location differed in soil texture, soil pH, elevation, slope, soil colour and topography. During two years of testing, Sia-LT produced more than twice the yield of the local check (Table 33).

Table 33. Yield (t/ha) of Sia-LT, Hohrae 3 and a local check from farmer's fields in 2014 and 2015.

Year	No. of sites	Sia-LT	Hohrae 3	Local
2014	74	8.6	12.0	5.1
2015	90	8.2	9.6	2.9
Average		8.4	10.8	4.0
The average yield above locals (%)		110	160	-

Farmers involved in this activity commented that they replanted Sia-LT because it is a vigorous plant, produced large tubers, the tubers were a unique colour (purple), and when cooked was soft, tasty and sweet. It is a short season variety, taking four and half months from planting to harvest. In locations with sufficient water and good conservation, farmer are able to replant and sell the surplus yield.

Agronomic adaptability

Variety SIA-LT maintains high yield and well adapted to the various condition. In high elevation site, this variety still showed good yields. However, in order to gain high and good yield, it is recommended to plant in the elevation below 1,000 meters. The cultivation technique applied to this variety is similar to common techniques applied on locals (prepare soil and cuttings, planting, maintenance and harvest).

Seed storage

Sweet potato can be planted in shaded area with sufficient water in order to support the growth process. Tubers of this variety is similar to other varieties which should be kept in shaded areas with sufficient humidity. Following appropriate storage procedures, tubers of Sia-LT can be stored for up to three months.

Disease and insect pest reaction

Similar to other sweet potatoes, Sia-LT is not resistant to weevil attack. However, Sia-LT is resistant to leaf scab, a common fungal disease in Timor-Leste during wet years.

Herbicide reaction

Herbicides are not used on sweet potato in Timor-Leste, so the reaction is unknown. There is possibility to identify the reaction in the future when farmers start to apply herbicides.

Impacts:

Economic benefits

Sia-LT has potential significant positive impact for farmers. The result of high production with good characteristics can provide more food for their families.

Farmers who produce surplus yields are able to sell in the local market to increase their income. Sia-LT is a common sweet potato found in many markets, and commands a price premium due to its distinctive colour.

Social benefits

Sia-LT will provide an alternative planting option for subsistence growers in Timor-Leste to increase their food production. Proper cultivation, higher yields and large tuber will help it contribute to greater food security.

Environmental impact

Sia-LT is a local variety that is commonly grown by some farmers. Therefore it is anticipated that it will not have negative impact to the environment.

Rice

Rice variety released name in Timor-Leste : Nakroma 1

-

Botanical name	: *Oriza sativa* L.
International name	: PR26645-B-7 (A)
Breeder /Institution	: PhilRice
Other information	: Released in the Philippines in 2004 as Mabango 1
Evaluation name in Timor-Leste	: M17
Suitable environment	: Irrigated rice field

Introduction

Rice is an essential food crop for Timor-Leste because majority of population consumes rice daily. In 2007 MAF-SoL released an irrigated rice variety named Nakroma, sourced from IRRI. To respond to the farmer's demand National Directorate of Research introduced a wide range of rice varieties from IRRI in 2009 to identify adapted rice varieties for Timor-Leste. Nakroma 1 is one of those 90 introductions.

Nakroma 1 is a lowland rice (irrigated rice) which was developed and issued by PhilRice in the Philippines through the Phillippine Seed Board with name 'NSIC Rc128'. It has been released in the Philippines as "Mabango 1" in 2004.

Nakroma 1 had consistent high yields each year in four administrative posts (Aileu, Baucau, Maliana and Atabae) when tested from 2012 to 2014 (Table 34). At taste tests associated with these replicated trials, the majority of farmers selected Nakroma 1 due to the good taste and bright white grain. Nakroma 1 was selected not only based on the yield performance but also the colour of rice, eating quality, tasty and fragrant smell. Therefore, this variety was selected for further research on farmer's field (OFDT) during planting season in 2014 and 2015.

Table 34 . Rice yields (t/ha) in replicated trials, 2012-2014

Location	Year/season	Nakroma 1	Nakroma	Local
Aileu	2012/wet	3.1	3.5	3.5
Atabae	2012/wet	1.0	1.4	0.9
Baucau	2012/wet	1.4	0.9	0.7
Aileu	2013/wet	2.3	1.4	1.8
Aileu	2013/dry	3.6	1.3	2.0
Baucau	2013/wet	4.3	2.6	2.5
Maliana	2013/wet	4.7	2.8	3.8
Maliana	2013/dry	2.8	1.3	1.8
Aileu	2014/wet	2.1	1.4	2.1
Baucau	2014/wet	2.4	3.2	3.0
Maliana	2014/wet	3.5	3.3	3.1
Maliana	2014/dry	5.8	3.1	4.5
Mean wet season		2.7	2.3	2.4
Mean dry season		4.0	1.9	2.8
Mean yield		3.1	2.2	2.5

On farm trials, 2014 and 2015

Participatory research was conducted with rice farmers to evaluate Nakroma 1 in five administrative posts. Nakroma 1 showed good yield and consistent during the two year period. The average yield from these trial locations represented the diverse locations of rice fields in Timor- Leste with elevation from sea level up to 1,500 masl. (Table 35)

Table 35. Rice yields (t/ha) in OFDTs, 2014 and 2015.

Year	Nakroma 1 (t/ha)	Nakroma (t/ha)	Local (t/ha)	Number of test locations
2014	3.1	2.7	2.6	57
2015	3.9	3.6	2.5	32
Average	3.5	3.2	2.6	
Yield advantage above local *(%)*	27	19		

Agronomic adaptability

Participatory research established in five administrative posts (Aileu, Balibo, Hatolia, Maliana and Venilale) showed that Nakroma1 was well adapted to the climate in Timor-Leste on farmer's field based on the cultivation method commonly used by farmer.

Nakroma 1 flowers and matures 3-4 days earlier than Nakroma, but has a higher yield. The slightly earlier maturity makes Nakroma 1 much more suited to areas with limited length of irrigation. As such Nakroma 1 should be recommended above Nakroma in irrigated areas on the north coast, like Manatuto and Atabae.

Description

Details of variety Nakroma 1 based on the information provided by rice research station in Philippines and trials conducted by MAF-SoL program are described below.

Table 36. Description of rice variety Nakroma 1

Yield (t/ha)		
	Filipina (Medium/maximum)	5.5 / 6.2
	TL wet (research site)	3.5
	TL dry (research site)	2.8
	TL rice field	3.5
	Yield above local (%)	27
	Maturity (Days to harvest)	
	Philippines	118
	TL dry	± 110-115
	TL wet	± 120
Plant height (cm)		
	Philippines	99
	TL wet	80
	TL dry	95
(# of tillers/hill)		
	Philippines	14
	TL wet	35-40
	TL dry	40-50
Reaction to		
	Blast	(Susceptible)
	Bacterial blight	(Intermediate)
	Sheath blight	(Intermediate)
	Tungro	(Susceptible)
	Stemborer (deadhearts)	(resistant)
	Stemborer (whiteheads)	(resistant)
	Green leafhopper	(Susceptible) (M.S)
	Brown Planthopper 1	Intermediate
	Brown Plant hopper 2	Intermediate
	Brown Plant hopper 3	Resistant

Disease and insect pest reaction

Nakroma 1 shows resistance to stemborer found in Timor-Leste. Stemborer is a very common insect pest of rice crops. Although the information from PhilRicce suggests that Nakroma 1 is susceptible to rice blast, there has been no reports of susceptability in the testing in Timor Leste.

Impact:

Economic benefits

Through the increased yields of Nakroma 1 farmers will are able to increase their income and sustain their daily lives. Nakroma 1 will offer planting option for rice farmer to produce food for their family because this variety posses good characteristic and showed consistent yield every year and also produce good quality seed.

Social benefits

Cultivation of Nakroma 1 provides one extra variety to diversify the selection for Timorese farmers and also to improved food security in Timor Leste.

Environmental impact

Nakroma 1 will increase the diversity of the current genetic pool in Timor-Leste. It is not a genetically modified organism (GMO) or bred using recombinant DNA technology.

References

Blair, M.W., Díaz, L.M., Buendía, H.F., Duque, M.C., 2009. Genetic diversity, seed size associations and population structure of a core collection of common beans (*Phaseolus vulgaris* L.). Theo App Gen 119 (6):955-972

Broughton, W.J., Hernández, G., Blair, M. S. B., Gepts, P., Vanderleyden, J. 2003. Beans (*Phaseolus* spp.) – model food legumes. Plant and Soil 252 (1):55-74

Smithson, J.B. (Ed.) 1990. Proceedings of the Second Workshop on Bean Research in Eastern Africa, Nairobi, Kenya,. CIAT African Workshop Series No. 7.Regional Programme on Bean Research in Eastern Africa, Debre Zeit, Ethiopia. Available at; http://pdf.usaid.gov/pdf_docs/PNABI213.pdf.

[UNICEF] Annual Research Report 2013. Timor-Leste

[USDA] United States Department of Agriculture 2016. National Nutrient Database for Standard Reference Release 28.

Filename:	Annual Research Report FINAL2
Directory:	C:\Users\user\Google Drive\Documents\SOL\ARR\2015 ARR
Template:	C:\Users\user\Google Drive\Documents\CWvKling.dotm
Title:	
Subject:	
Author:	user
Keywords:	
Comments:	
Creation Date:	6/29/2016 8:50:00 AM
Change Number:	15
Last Saved On:	6/29/2016 10:50:00 AM
Last Saved By:	user
Total Editing Time:	57 Minutes
Last Printed On:	6/29/2016 10:50:00 AM

As of Last Complete Printing

Number of Pages:	49
Number of Words:	14,349 (approx.)
Number of Characters:	81,794 (approx.)