



# Study on the Use of Drip Irrigation by Shallot Farmers

March 2022



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# Abbreviations & Acronyms

AEW	Agricultural extension worker
CMS	Crop Monitoring System
Demplot	Demonstration plot
FFD	Farmer Field Day
FFS	Farmer Field School
FGD	Focus group discussion
GAP	Good agricultural practices
MAF	Ministry of Agriculture and Fisheries
NSA	Nutrition-sensitive agriculture
PO	Project Officer
TOMAK	<i>To'os ba Moris Di'ak</i> (Farming for Prosperity) Program

# Summary of Key Findings

This study was undertaken with farmers that had previously used drip irrigation and farmers that had never used drip irrigation to ascertain the key enablers and constraints to the adoption of drip irrigation technology. Key findings from the two groups of farmers include:

## Farmers that had used drip irrigation

Results from the study show that overall only a few farmers had started using drip irrigation in 2017, with most farmers starting to use drip irrigation from 2018-2021. A small number of farmers used drip irrigation for two planting seasons, some had continued using drip irrigation until the time of the study (2021), while some had not continued using it due to limited access to water or because the drip system had been damaged after the first year. From 381 farmers who had expanded their shallot/onion production, only a few had continued to use drip irrigation.

The majority of farmers who had used irrigation knew how to install it because a MAF agricultural extension worker (AEW) or TOMAK staff member had shown them initially, and they reported that they knew how to install it themselves the following season.

In general, farmers were happy with the results of using drip irrigation and noted it had a positive impact on production, with more and larger shallots/onions produced. Drip irrigation was found to be helpful for farmers in reducing their workload and helping manage time. Women farmers noted being able to carry out domestic tasks at the same time as shallots/onions were being watered through the drip irrigation system. Men reported that they were able to carry out other tasks instead of spending time watering.

Drip irrigation was found to be water efficient and required only moderate amounts of water to irrigate a large number of planting beds, with water being distributed evenly to all the beds.

Some farmers were aware of stores in Dili which sell drip irrigation, particularly those who had purchased it for themselves, while others did not yet know of these stores. The majority of women farmers reported being unaware of stores in Dili, noting that they would prefer to buy equipment in their municipality or suku (village). Farmers who had not yet purchased drip irrigation for themselves reported that TOMAK had previously transported the equipment directly to them, with some farmers stating that going forward they were prepared to purchase it themselves in the absence of TOMAK support.

The majority of farmers who had purchased drip irrigation using a 50% cost-share arrangement with TOMAK described drip irrigation as inexpensive, with only one or two farmers reporting that drip irrigation was expensive. Farmers who had purchased drip irrigation said that the equipment was affordable compared to the profit returned after using it. Some farmers had already invested in drip irrigation while others had not yet invested their own funds.

Multiple factors impeded farmers from continuing to use drip irrigation including insufficient access to a suitable volume of clean water and/or the use of unclean river water, resulting in blockages in the irrigation system. Other farmers reported that their land is not sufficiently flat, thus making it difficult to lay the drip irrigation appropriately. Other farmers reported limited knowledge about maintenance and storage for drip irrigation.

## **Farmers that had never used drip irrigation**

Respondents who had never used drip irrigation reported that they use a traditional watering system using irrigation canals and/or manually watering using a watering can. Some farmers reported accessing a water source using a regular hose. Traditional methods did not provide many benefits for farmers, with farmers reporting production of smaller shallots/onions and needing to stand for many hours to water their crop resulting in sore arms and legs. Farmers were unable to undertake other work while watering their shallots/onions, with women farmers in particular reporting less time for domestic tasks.

Key barriers to adopting drip irrigation were access to water and insufficient funds to buy drip irrigation (households choosing to prioritise basic necessities and education expenses instead). Additionally, some farmers were aware of other farmers' experiences where drip irrigation had not been durable over the long term, had broken, and/or was no longer in use.

The majority of these farmers reported hearing information from a MAF AEW or TOMAK staff member about the benefits of drip irrigation, including improving the quality of shallots/onions, reducing workload and labour inputs, and supporting better time and water management. They had also heard information about the 50% cost-share arrangement between TOMAK and farmers.

# Main Report

## 1. Introduction

### 1.1. About TOMAK

The To'os Ba Moris Di'ak Program (TOMAK) is a five plus five year agricultural livelihoods program implemented in Timor-Leste with funding from the Australian Department of Foreign Affairs and Trade (DFAT). Its goal is to ensure rural households live more prosperous and sustainable lives. Since 2016, TOMAK has worked with key partners (including the Government of Timor-Leste (GoTL)) to implement a range of interventions which aimed to:

- Establish a foundation of food security and good nutrition for targeted rural communities (Component 1); and
- Build capacity so these communities can confidently and ably engage in profitable agricultural markets (Component 2).

Component 1 (Food Security and Nutrition) promoted nutrition-sensitive agriculture (NSA) approaches to improve the availability and utilisation of nutritious food. Component 2 (Market System Development) promoted the development of commercial agriculture following a market systems development approach, focussing on selected higher-potential value chains. Gender equality and social inclusion (GESI) was embedded in the planning, implementation and monitoring of activities across the program.

### 1.2. About drip irrigation

Throughout Phase 1, TOMAK promoted the use of drip irrigation systems as a key water management approach to improve the production of the shallot/onion value chain. Drip irrigation contributes to household climate resilience as the system helps improve water management and distributes water evenly to all shallots/onions in a planting bed. The system also reduces labour required for watering, thus allowing farmers to better manage their time.



*A drip irrigation system mounted on a planting bed for shallots.*

How to use the drip irrigation system was included in TOMAK's farmer handbook for how to plant shallots/onions. TOMAK also promoted the technique through Farmer Field School (FFS) activities held on farmer-hosted demonstration plots (demplots). Farming households participating in the demplot program allocated a 12m<sup>2</sup> plot (10m x 1.2m) per shallot/onion variety, with some farmers establishing demonstrations for 3-4 different seed varieties. At each demplot, neighbouring farmers were invited to participate and learn recommended good agricultural practices (GAP) together, starting from land preparation, establishing a nursery, transplanting seedlings, and use of the drip irrigation system. This culminated in a Farmer Field Day (FFD) harvest event at the end of the cropping season.

Farmers who hosted demplots received drip irrigation at no cost from TOMAK during their first season.<sup>1</sup> In the subsequent season, farmers who wanted to expand their shallot/onion production to a larger area were offered a 50% cost-share arrangement with TOMAK for any associated inputs including drip irrigation.

Final indications were that not all farmers were using drip irrigation by the end of Phase 1. As a result, this additional study was developed to determine the impact of drip irrigation, including farmers' basic knowledge and practices.

### ***1.3. Study objectives***

The objectives of this study were:

- To understand if drip irrigation systems were being used and for how many production cycles;
- To understand the benefits of drip irrigation, such as impacts on time management, women's time, labour savings, efficient use of water and distribution of water to planting beds;
- To understand how drip irrigation equipment is maintained and stored after each use.

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<sup>1</sup> The total amount of drip irrigation provided to farmers for their demplot was based on the number of planting beds each farmer had. Each bed required approximately 4 x 10m of drip irrigation for shallot and 3 x 10m of drip irrigation for Bombay onions.

## 2. Methodology

Two qualitative methods of data collection were utilised. The first was a series of focus group discussions (FGDs) with men and women farmers who had used drip irrigation. A total of 10 FGDs were carried out with five women's groups and five men's groups. Secondly, semi-structured interviews were carried out with farmers who had not used drip irrigation (three women and two men farmers).

Participant selection was carried out by TOMAK project officers (POs) in Baucau, Bobonaro and Viqueque municipalities. Tables 1 and 2 provide details of the participants involved in the study.

**Table 1. Focus group discussion (FGD) participants**

Municipality	Suku(s)	Group type	Total participants
Baucau	Uailaha	Men	6
Baucau	Uma Ana-Ico, Uailili	Men	2
Baucau	Uailaha	Women	3
Baucau	Uma Ana-Ico, Uailili	Women	5
Bobonaro	Lahomea, Odomau, Leohitu, Hataz, Raifun, Ritabou	Men	9
Bobonaro	Atuaben, Ilatlaun, Soilesu	Men	11
Bobonaro	Lahomea, Odomau, Leohitu, Hataz, Raifun, Ritabou	Women	6
Bobonaro	Atuaben, Ilatlaun, Soilesu	Women	11
Viqueque	Uaguia	Men	5
Viqueque	Uaguia	Women	6

**Table 2. Semi-structured interview participants**

Municipality	Suku	No. of respondents
Baucau	Uailaha	2 (female & male)
Bobonaro	Raifun	2 (female & male)
Viqueque	Uaguia	1 (female)

Data was collected between 24 November and 17 December 2021. Data collection was carried out by two TOMAK POs in each municipality with additional support from the TOMAK Regional Manager in Baucau. The TOMAK M&E Manager conducted data analysis and wrote the original report in Tetum with support from the TOMAK M&E Specialist. The report was subsequently reviewed by the TOMAK technical team before being translated to English.

## **2.1. Study limitations**

There is a need to refine methodological tools that require numerical responses such as the number of planting beds farmers had and the number of beds for which they used drip irrigation. It was difficult to analyse this data because husbands and wives from the same household were involved in the women's and men's FGDs which meant that data may have been counted twice.

The study required high-level facilitation skills to carry out group discussions with farmers in order to understand their responses and follow up with probing questions. Although training in this regard was provided to the facilitators, qualitative data collection is challenging and requires a unique set of skills that take considerable training and practice to develop. In Phase 2, TOMAK should continue to provide training to regional staff on best practice approaches to conducting FGDs and semi-structured interviews.

Data collection should also be carried out with respect to the agricultural calendar, so that farmers are not busy with other activities such as planting and harvest. Some farmers were unable to participate in the study due to farming commitments or because study activities were carried out on market days when farmers needed to take their produce for sale.

### 3. Study Results

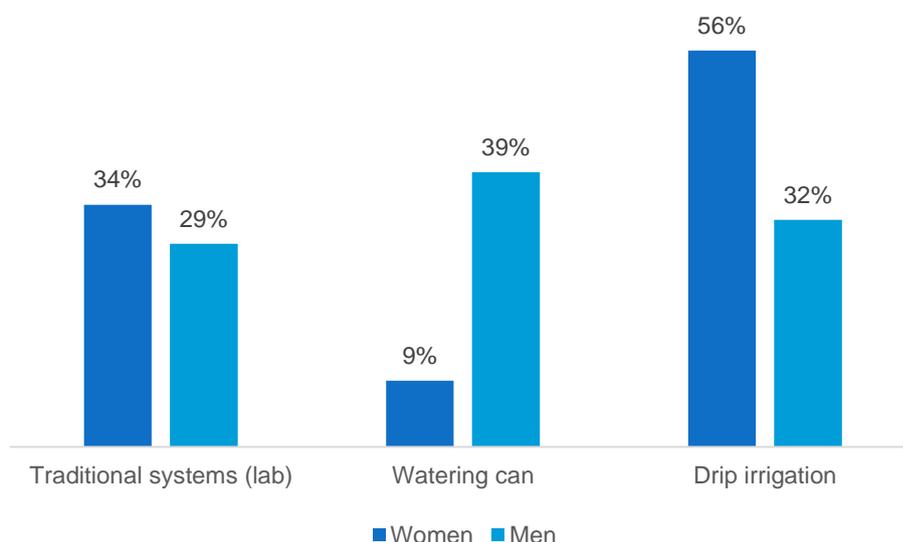
#### 3.1. Farmers that had used drip irrigation

##### 3.1.1. When and how drip irrigation was used

The TOMAK database or Crop Monitoring System (CMS) shows that at the time of the study, there were 381 expanding shallot farmers located in the three target municipalities. A total of 39 households participated in this study on drip irrigation. From these households, 67% had commenced with a demplot before expanding production, while 33% had started as expansion farmers (without having hosted a demplot first).

Although TOMAK promoted the use of drip irrigation as a water efficient practice and some farmers had adopted this practice, farmers also continued using traditional systems (such as the 'lab' system of letting water run around planting beds and then manually watering the beds) or using a watering can/hose). Farmers reported that this was due to making new planting beds and/or having insufficient funds to purchase more drip irrigation, and because they had made planting beds on uneven land. Figure 1 shows general information from participants about the irrigation systems they used.

**Figure 1. Irrigation systems used by farmers (from female and male FGDs)**



A small number of farmers started using drip irrigation in 2017 when TOMAK first began establishing demplots and introducing this system, but the majority commenced between 2018-2021. The majority of farmers hosted a demplot before deciding to expand their production, although some farmers that used drip irrigation had started as expansion farmers. Farmers had a minimum of two planting beds to a maximum of 20 beds which they used to grow shallots/onions. Some farmers used drip irrigation on all of their planting beds, although others used drip irrigation on only some of the total number of beds. Almost all farmers said that they used drip irrigation less after the first two seasons (or one year), although some said they continued to use drip irrigation until the present day, and others said they had stopped because the drip irrigation had broken and was difficult to fix or they did not have sufficient money to buy new equipment.

##### 3.1.2. Access, installation and maintenance

The majority of farmers stated that they had accessed drip irrigation through TOMAK, with some reporting that they had accessed drip irrigation directly from Dili stores such as Vinod Patel and Agi Agrikultura. The majority of male farmers in Bobonaro knew of input supply stores in Dili and in

Maliana, while only a few women knew of these stores. They reported that in future, they would prefer to buy drip irrigation from a local collector who supplies inputs in their suku. This local collector is also a beneficiary shallot farmer from suku Soilesu, Bobonaro.<sup>2</sup> FGDs with women in Baucau and Viqueque revealed that the majority did not know which stores sell drip irrigation in Dili. Some male farmers knew the names of the stores, while others did not. Farmers who did not know which stores sell drip irrigation advised that MAF and TOMAK staff could link them with these stores so that in the future, they could buy drip irrigation themselves. All farmers expressed their hope that drip irrigation equipment would be sold at municipal or suku level.

Almost all farmers in the three municipalities said that drip irrigation is inexpensive because of the 50% cost-share arrangement with TOMAK. A few farmers reported that drip irrigation is expensive even though TOMAK subsidised 50% of the cost. Despite this, the few farmers that had purchased drip irrigation independently noted that when they calculated the results of using drip irrigation on their shallot production, the data showed that drip irrigation was an inexpensive investment. While farmers noted concerns about the cost of drip irrigation, overall they noted that in future they would like to buy the equipment themselves.

At the time of the study, only a few farmers had used money from their shallot production to buy more drip irrigation, while many had yet to do this. Farmers that had yet to purchase drip irrigation noted that in future they would like to invest money from shallot production for this purpose. Farmers that had invested their own money in drip irrigation noted that before starting production, they need to invest in their own farm by purchasing inputs like drip irrigation.

One barrier for farmers investing money to buy drip irrigation was access to clean water (as farmers reported that dirty water can clog the irrigation system) and also needing sufficiently good production results to earn the money required. Farmers reported that when TOMAK no longer provides a 50% cost-share, they would like to buy drip irrigation themselves provided that they have good access to water and good production results.

The situation was slightly different in Viqueque, with some farmers from both the women and men's groups reporting that they had not yet purchased drip irrigation because of farm conditions such as soil with a sticky texture and sloping land, which were viewed as inappropriate for using drip irrigation. These farmers preferred to use the traditional 'lab' system despite having seen drip irrigation demonstrated at FFS activities.

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<sup>2</sup> One TOMAK beneficiary shallot farmer had begun collecting shallots from neighbouring farmers in order to sell to retail outlets. The same farmer collector had also begun purchasing and selling agricultural inputs to neighbouring farmers..



*A farmer uses the traditional 'lab' system to water shallots.*

The majority of farmers in the three municipalities said that drip irrigation was easy to install. FGDs with women and men revealed that farmers had seen the installation during FFS activities and could install the system themselves if an AEW or TOMAK staff were not present. TOMAK and MAF AEWs had shown farmers how to install drip irrigation in the first season, before farmers had continued installing it themselves in subsequent seasons.

Maintenance practices for drip irrigation equipment were similar in all three municipalities and followed advice from TOMAK and MAF AEWs. The majority of women and men farmers said that when the system had a hole, they would cut the end off one of the hoses and use it to close the hole. On the other hand, despite AEWs providing advice on appropriate maintenance practices, some farmers were still using plastic pipes to cover holes/joints or wrapping plastic around hoses that had broken/split.

Some farmers, especially women, did not yet understand the function of the disc filter despite the guide explaining clearly the need to use a disc filter before letting water or liquid fertiliser run through the drip irrigation. The disc filter serves the function of straining or filtering water so that the drip irrigation system does not become blocked.

The majority of farmers in the three municipalities stored their drip irrigation equipment in the same way. After completing harvest of their shallots, farmers reported that they rinsed the drip irrigation with clean water to remove any dirt or rocks from inside the hoses. Some farmers used clean water, while other farmers reported using water and detergent such as Rinso or Bayclean.<sup>3</sup> Once clean, farmers reported hanging the irrigation equipment in the sun to dry before storing.

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<sup>3</sup> This practice is included in the farmer guide for planting shallots under the drip irrigation topic.



*A farmer and MAF AEW remove drip irrigation from a planting bed after harvesting shallots.*

FGDs revealed that most farmers stored their drip irrigation correctly. They stored drip irrigation in a number of ways including tying the hoses together and hanging them inside the house, tying together and placing on a bamboo shelf/platform, or tying together and placing inside a sack, bucket or box.

### *3.1.3. Benefits and challenges*

In general, farmers were pleased with the benefits of using drip irrigation and reported strong production results with more and larger shallots. The majority of women and men shared the same experiences of using drip irrigation including that the system helps farmers save time and energy watering shallots, reduces workload and allows farmers to do other activities at the same time. Women reported that it was easy to turn the water on and off, and in between they would be able to carry out domestic tasks or run their business.

Men also reported that they could do other activities away from the farm without worrying about returning quickly to water their crops. Farmers reported that when using the traditional 'lab' system or using a watering can/hose, women and men need to water together in order to finish the job quickly before the day becomes too hot. These systems were described as tiresome due to the length of time required to manually water multiple planting beds, and also ruled out any other tasks being carried out at the same time, especially for farmers with six or more planting beds to water.

Farmers reported that using drip irrigation made it easy to control the flow of water and that they did not need to walk through the planting beds pushing the small shallot bulbs back into the soil. They described the distribution of water as even and soil containing the same level of moisture from top to bottom. The water efficiency of the system allowed farmers to save water. *"We rely on the public water system which has a schedule for when households can access water. The drip irrigation system saves water, for example if we have one drum of water, we can use it to water 5-10 shallot beds,"* said one farmer from Bobonaro. Some farmers reported that they also applied liquid organic fertiliser using the drip irrigation system. Farmers reported that water distribution from drip irrigation was preferred to manual watering or traditional systems which sometimes destroyed shallots when too much water was applied, and could result in insufficient water when planting beds were large or many. Some farmers reported that they had applied fertiliser (animal manure, compost or chemical

fertilisers) but that the fertiliser had washed away if they watered their crop using a regular hose or watering can.

Farmer perspectives on the advantages and disadvantages of drip irrigation depended on multiple factors. Key supporting factors included water access and topography of the land. Farmers had varied access to water and farmers who had access to clean water through a public water system reported few problems. These farmers were happy using drip irrigation and had started to buy it for themselves. But farmers without adequate access to clean water, such as those accessing water from a nearby river or spring faced problems of dirty water and rocks blocking and/or destroying the irrigation hoses. Although the drip irrigation used a filter disc, farmers reported that they spent significant time to regularly clean the system. Drip irrigation should be washed using clean water and farmers expressed concern over their lack of access to clean water. There were different perspectives about the volume of water used. Farmers accessing water from a river or spring said that too much water could clog the drip irrigation with dirt and damage it. Some farmers said that drip irrigation required a large volume of water. Some farmers had limited access to water but had not built a mini dam to gather water to be used in the drip irrigation system (as suggested in the training materials).

The majority of farmers in Viqueque who participated in this study said that sloping land conditions impeded use of drip irrigation. TOMAK and MAF had recommended to farmers that drip irrigation should be laid flat and sloping land should be levelled into terraces in order to use drip irrigation.<sup>4</sup> Despite this, some farmers decided not to use drip irrigation because their planting beds were built on uneven land.

From the respondents, one farmer from Baucau and two farmers from Bobonaro were using electricity to access water. A further two farmers in Baucau had previously used a solar cell to pump water but were no longer using these because they had stopped working. The majority of respondents who had access to the public water system were using electricity and could manage use of the drip irrigation system well, with one farmer saying that when the power was out they had to wait until the power came back on to water their shallots. These farmers encountered difficulties with the public system which sometimes had insufficient water, and because they only had access based on the schedule determined by local authorities in their suku or aldeia. Some farmers collected rain water during the rainy season and saved this for use in the dry season. Some of the farmers who collected water using a tank, used the water not only to water shallots but to raise fish. In terms of the cost of electricity, farmers said this was not a large expense when compared with the resulting production. *“Spending \$15 a month for all the crops and what we need in the house adds up to \$60 over four months, but when compared with the results and the bigger shallots produced, I make a profit,”* said a male farmer from Hataz suku, Bobonaro.

Other challenges reported by farmers include that after the first season’s installation, the drip irrigation was not in as good condition in subsequent seasons. Farmers reported that multiple people would be needed to maintain the drip irrigation, including taking it apart and cleaning it when it became blocked. Some farmers reported that the drip irrigation hoses became dry and split when left on the planting bed while they were cultivating shallots. Farmers also noted that it was difficult to take care of drip irrigation if their field was far from the house because people could steal the system and it could be destroyed by animals. Some farmers reported that if they stored the drip irrigation too long, it would be damaged by rats.

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<sup>4</sup> Good agricultural practices (GAP) promoted by TOMAK and MAF suggested that if planting beds were made on sloping land, terraces should be established in order to level the land and allow for drip irrigation to be used effectively.

### **3.2. Farmers that had never used drip irrigation**

#### **3.2.1. Experiences using traditional systems and watering cans**

Five farmers who participated in this study had never used drip irrigation. These farmers were shallot expansion farmers who had been taught how to use drip irrigation during FFS activities carried out on demplots. Three farmers had started growing shallots with support from TOMAK in 2019, while the other two had started in 2020-21.

These farmers used traditional watering systems and watering cans to water their shallot crop. Some were using hoses directly from a spring or water source. The majority of these farmers reported that they did not have good results from their shallot production, with smaller and fewer shallots produced. When watering, they needed to take care not to disturb the roots of the shallots so that they would not be washed away. Farmers reported that watering with a hose or watering can could break up the planting beds, and could result in tough or overly wet soil. Water was also a challenge for these farmers as using a regular hose required a large volume of water, particularly in the dry season. Accessing community water systems based on a schedule meant that farmers did not always have access to sufficient water, which affected the growth of shallots.



*Farmers use plastic watering cans to water shallot planting beds.*

Another difficulty reported by farmers was the length of time spent standing and holding a hose or watering can, which could take up to two hours to water eight planting beds. This had a significant impact on farmers' time and their ability to carry out other tasks such as weeding, looking after other crops or engaging in business. Additionally, women farmers reported being unable to carry out other domestic activities while watering their crop. "I have four planting beds and it takes an hour to water them all, during that hour I cannot do anything else like planting tomatoes, chilies or removing weeds," stated one male farmer from Raifun suku, Bobonaro.

#### **3.2.2. Information received from TOMAK/AEWs**

In general, farmers reported that TOMAK and MAF AEWs had explained the 50% cost-share arrangement between TOMAK and farmers that could be used to purchase drip irrigation. Only one respondent said that they had not heard this information. Farmers had also been informed about the benefits of using drip irrigation including even distribution of water across all planting beds and more

efficient use of water (needing a smaller volume of water to cover a larger area). Additionally, farmers knew that drip irrigation could help with time management, particularly in allowing women to carry out other tasks at the same time.

In terms of access to drip irrigation, farmers reported that TOMAK had transported the equipment to them and that they had learned to use it through FFS activities, together with other farmers. However, farmers noted that other equipment such as hoses and watering cans were available in their municipality. They noted that accessing drip irrigation was difficult and asked TOMAK and MAF to consider ways to make drip irrigation available at municipal supply stores.

Some farmers had forgotten what they had learned in FFS activities and asked that TOMAK and MAF AEWs support them again to install drip irrigation so that they could learn how to install it themselves in future.



*A MAF AEW explains to farmers how to use drip irrigation during a transplanting activity.*

## 4. Conclusion and Recommendations

### 4.1. Conclusion

All farmers expressed interest in using drip irrigation, having seen first-hand the benefits of using this system. However, several challenges remain that require consideration in Phase 2. Key conclusions from this study are summarised in the table below:

Description	Farmers that had used drip irrigation	Farmers that had never used drip irrigation
When and how drip irrigation is used	<p>Many farmers had expanded their production of shallots, however not all of these farmers had used drip irrigation, particularly those who had not hosted a demplot (joined directly as an expansion farmer). Some used drip irrigation on all their planting beds, while some were using drip irrigation on only some of their watering beds because they had just built new planting beds, were planting on uneven ground, or did not have sufficient funds to purchase the equipment.</p> <p>Most farmers started using drip irrigation from 2018 to 2021, with a small number starting in 2017.</p>	<p>These farmers had been supported by TOMAK since 2018 (earliest) but had not yet used drip irrigation</p>
Access to drip irrigation	<p>TOMAK transported equipment directly to farmers, particularly for demplot farmers and those who took advantage of the 50% cost-share arrangement.</p> <p>Some male farmers knew which stores sell drip irrigation, while others did not. The majority of women farmers did not know which stores sell drip irrigation. Drip irrigation is typically only sold in Dili. Farmers would prefer to purchase drip irrigation in their municipality or suku.</p>	<p>Farmers who had never used drip irrigation did not know which stores sell drip irrigation. They were only aware of regular watering equipment (hoses, watering cans) sold in their suku or municipality.</p>
Price	<p>In general, farmers that had used the 50% cost-share arrangement to purchase drip irrigation said that it is inexpensive, with only one or two believing it to be expensive.</p> <p>Farmers who had used their own money to purchase drip irrigation believed it to be inexpensive when compared to the results they achieved when using it.</p>	<p>Farmers reported that they had not purchased drip irrigation because it is expensive, despite having heard about the 50% cost-share arrangement with TOMAK.</p>
Installation	<p>All farmers knew how to install drip irrigation, having learned from TOMAK POs and MAF AEWs. They stated that they were able to install it themselves after the first season.</p>	<p>The majority of these farmers had learned how to install drip irrigation during FFS activities. None had done the installation themselves having not used drip irrigation on their farm.</p>
Maintenance	<p>Drip irrigation was supplied with a filter disc but some farmers did not know how to use it. Farmers stated that when the drip irrigation</p>	<p>Not applicable.</p>

Description	Farmers that had used drip irrigation	Farmers that had never used drip irrigation
	<p>became dirty or blocked, they would dismantle it and rinse it with clean water. All farmers had similar experiences with maintenance, and most knew to use the end of the hose to repair any holes. Some farmers had not followed recommendations from TOMAK and had used plastic pipe or plastic to repair damage.</p>	
Storage	<p>The majority of farmers reported that they stored their drip irrigation after harvest. After rinsing and drying the hoses, there were a few methods used for storing drip irrigation including: hanging, storing on a bamboo platform/shelf, and placing in a sack or bucket.</p>	Not applicable.
Advantages and challenges experienced with using and not using drip irrigation	<p>Even water distribution to all planting beds and more water efficient: a small amount of water can be used for all planting beds. Soil is moist from top to the bottom.</p> <p>Can manage time well and do other tasks while watering shallots such as other farm activities, business, and domestic tasks (particularly for women farmers).</p> <p>Requires only one person to manage watering and saves energy.</p> <p>Results in more and larger shallots.</p> <p><u>Reasons farmers did not continue using drip irrigation:</u></p> <p>Had built more planting beds, insufficient production of shallots, belief that the equipment is expensive, inadequate access to water (clean water not sufficient, water from river dirty)</p>	<p>Uneven distribution of water, soil overly wet or tough, traditional systems can damage the planting beds and destroy shallots.</p> <p>Cannot carry out other work while watering shallots, such as weeding, business, or domestic tasks (particularly for women farmers).</p> <p>Requires many people to water using a hose or watering cans. Requires a lot of time to water shallots. Resulting shallots fewer and smaller.</p> <p><u>Reasons farmers never used drip irrigation:</u></p> <p>Small production of shallots, belief that drip irrigation is expensive, insufficient funds to purchase, inadequate access to water, saw that neighbour's drip irrigation was damaged.</p> <p>In Viqueque, farmers reported that sloping land made it difficult to lay drip irrigation despite TOMAK and MAF advice to level sloping land (terracing) in order to build planting beds and use drip irrigation.</p>

## **4.2. Recommendations**

The study showed positive impacts for farmers that had used drip irrigation, including improved quality of shallots, labour and time savings, and efficient use of water. In terms of the sustainability of drip irrigation, several factors that impede farmer uptake should be considered. Recommendations for how TOMAK might continue to promote drip irrigation can be found below:

### *4.2.1. Recommendations for TOMAK*

- Guidance for using drip irrigation is not complete and is included in the manual for how to produce shallots/onions. A separate manual should be developed that focuses specifically on drip irrigation.
- Introduce drip irrigation to farmers based on the condition of their land and their access to water. Establish water collection systems and show how to use these with drip irrigation.
- Reinforce the benefits of using electricity (or solar cells) to power drip irrigation depending on water conditions. Support farmers to calculate expenses and compare these to production results so that farmers can better understand the benefits.
- Increase the focus on maintenance and storage of drip irrigation during FFS activities.
- Link agricultural supply stores and private sector actors at municipal level to Dili supply stores to develop opportunities for local sales of drip irrigation.
- Include information about the benefits of drip irrigation in cross-visit activities between farmers.
- Consider the experiences of farmers in Viqueque who prefer the traditional 'lab' system and watering cans to drip irrigation due to the texture of their soil (sticky) and sloping land characteristics. TOMAK could organise refresher GAP training for AEWs and mentoring for expansion farmers to ensure recommended practices for the use of drip irrigation are adopted in these types of areas.

### *4.2.2. Recommendations from farmers to TOMAK*

- Recommend other farmers use drip irrigation due to the production benefits for shallot.
- Recommend TOMAK continue offering farmers 50% cost-share arrangements and arranging transport for supply of drip irrigation.
- Preference is to use drip irrigation but this depends on income from shallot sales and consistent supply of clean water.

# Annex 1: Semi-structured interview guide for farmers who do not use drip irrigation

## Consent

Good morning/afternoon. My name is (*interviewer*) and I am conducting a short study to help TOMAK improve its activities with farmers relating to drip irrigation for shallots.

Your household has been chosen to participate in a survey, as part of a sample of households that do not use drip irrigation. I would like to know a bit more about why your family does not use this system that TOMAK has promoted.

The discussion will take around 30 minutes.

The information you provide is secret and will only be used by the TOMAK program.

We may also use your photo or name in our reports and these reports may appear on the TOMAK website.

Do you agree to be interviewed? Yes/No (*circle one*)

(*Interviewer should stop and seek another participant if the respondent does not wish to participate*)

a. Date of interview:	b. Interviewer:
c. Name of respondent:	d. Sex of respondent:
e. Year of birth:	f. Family members:
g. Municipality:	h. Administrative post:
i. Suku:	j. Aldeia:

1. Did you start planting shallots with a demplot or only attend an FFS and then expand your production area?
2. What year did you begin receiving support from TOMAK?
3. What system do you use to water your shallots (*PO: note that some farmers use traditional 'lab' systems/watering cans*)
4. Why do you prefer to keep using traditional systems instead of drip irrigation?
5. Did the MAF AEW/TOMAK explain about the 50% cost-share arrangement? If yes, why did you choose not to participate?
6. Did the MAF AEW/TOMAK explain about the benefits of using drip irrigation? If yes, can you explain these to me?
7. Do you know where you can go to access or buy drip irrigation? In your opinion, is it easy to access these places?
8. What difficulties have you encountered when you use traditional systems or a watering can to water your shallots?
9. How many planting beds/areas do you have? How long does it take you to water your shallots? (probe: does this affect your other activities? Can you provide an example?)
10. What are the obstacles to using the drip irrigation system?
11. What is your plan for the future? Would you like to use drip irrigation? If not, why not?

## Annex 2: Focus group discussion (FGD) guide

FGD with shallot farmers to see the impacts of using drip irrigation

### **Consent**

Good morning/afternoon. My name is (facilitator) and my colleague's name is (co-facilitator if applicable) and today we would like to talk with you a little and hear your views on shallot activities that you have been involved in, in particular how you have used drip irrigation. We would like to know more about the impact of drip irrigation and whether this has been helpful to you or not.

The discussion will last approximately one and a half hours. You are free to talk about anything you have learned as well as anything that has gone well or not gone well.

The information you provide is secret and will only be used by the TOMAK program.

Do you agree to be interviewed? Yes or no?

*(Facilitator should allow any participants who do not wish to participate to leave).*

*Facilitator (PO) should prepare the registration form for participants as well as a recorder (use a tablet) to make a recording of the discussion.*

*Remember to ask permission from the participants before recording the discussion.*

Questions	Guideline ba PO (Probe)	Responses
<b>INFORMATION/BASIC KNOWLEDGE</b>		
1. Did you start planting shallots with a demplot or only attend an FFS and then expand your production area?	PO: <i>(ask everyone and count how many in each group)</i> <ul style="list-style-type: none"> <li>How many started with demplots</li> <li>How many attended FFS and started as expansion farmers?</li> </ul>	<ul style="list-style-type: none"> <li>Demplot # _____</li> <li>FFS and direct expansion # _____</li> </ul>
2. What system do you use to water your shallots? Do you use drip irrigation for all planting beds or just some?	PO: Count how many participants use each system: <ul style="list-style-type: none"> <li>How many use a traditional 'lab' system?</li> <li>How many use a watering can?</li> <li>How many use drip irrigation</li> </ul> PO: Probe For responses 1 & 2: Why do you still use these systems? Check if they still use drip irrigation and if not why not?	<ul style="list-style-type: none"> <li>Traditional/lab system? # _____</li> <li>Watering can? # _____</li> <li>Drip irrigation? # _____</li> </ul> Why?

	Count for each participant: If using for only some planting beds, for how many do you use drip irrigation? From how many planting beds total?	P1. Total # beds___using only for #___planting beds P2. Total # beds___using only for #___planting beds P3. Total # beds___using only for #___planting beds P4. Total # beds___using only for #___planting beds P5. Total # beds___using only for #___planting beds P6. Total # beds___using only for #___planting beds Why don't you use drip irrigation for all?
3. Is the supply of water sufficient for you to grow shallots each season?	PO: Probe Is there any conflict or problem relating to the supply of water? (e.g. shared water insufficient, need to pay for water)	
4. When did you start to use drip irrigation?	PO: <i>write the month and year for each participant (if there is a difference between participants)</i>	
5. Can you share a bit about what you know of drip irrigation? What do you think of this system?	PO: Probe What worked well? What didn't work well?	Worked well:
		Did not work well:
6. What are the benefits of using drip irrigation?	PO: Probe based on the points below but do not lead or suggest responses: <ul style="list-style-type: none"> <li>• Managing time (being able to do other work) provide examples...</li> <li>• Women's time</li> <li>• Reduced workload</li> <li>• Even distribution of water</li> <li>• Water efficiency</li> </ul>	Time management:  Women's time:  Reduce workload:  Water distribution:  Water efficiency:
7. How did you access drip irrigation?	PO: Count the number of participants in each category <ul style="list-style-type: none"> <li>• Received free from TOMAK?</li> <li>• Bought using a 50% cost-share?</li> <li>• Bought independently?</li> </ul>	<ul style="list-style-type: none"> <li>• Received free from TOMAK #_____</li> <li>• Bought with 50% cost-share #_____</li> <li>• Bought independently #_____</li> </ul>

	PO: Probe <ul style="list-style-type: none"> <li>• Where did you buy it?</li> <li>• Did you think it was cheap or expensive?</li> <li>• Is it easy or difficult for you to access/buy drip irrigation if one day the system becomes damaged?</li> </ul>	-
<b>PRACTICES AND MAINTENANCE</b>		
8. Did you use drip irrigation only on the demplot or did you continue using it when you expanded your production area?	PO: Record how many people and ask why  Did not continue # _____ why?  Continued # _____ why? - If continued, approximately how many planting beds did they cover?  How many years did you use this system? For how many planting seasons did you use it? <i>(PO: If all the respondents answer the same, put the number of people who selected that response, but different responses should be written separately)</i>	Did not continue # _____ why?  Continued # _____ why?  P1. Number of years__ Used for how many seasons #__ P2. Number of years__ Used for how many seasons #__ P3. Number of years__ Used for how many seasons #__ P4. Number of years__ Used for how many seasons #__ P5. Number of years__ Used for how many seasons #__ P6. Number of years__ Used for how many seasons #__
9. Was it easy or difficult to install the irrigation system?	PO: Probe <ul style="list-style-type: none"> <li>• Who helped you to install the system?</li> <li>• Going forward can you install it yourself or do you need assistance (installing the system each season)?</li> <li>• If it broke, who would you ask to help you?</li> </ul>	
10. Do you prefer using drip irrigation or traditional systems? Please explain why	PO: Probe What do you see as the differences between using a traditional system and drip irrigation?	
11. How do you maintain the drip irrigation equipment?	PO: Probe Have you cleaned the hose or filter, repaired any holes, etc?	

12. How do you store the drip irrigation equipment?	PO: Probe Once you have harvested your crop, what do you with the drip irrigation system?	
13. Did you use the drip irrigation with electricity or a solar cell?	PO: This question only refers to farmers that have access to electricity or a solar cell. Electricity # _____ Solar cell # _____ PO: Probe, if no longer using, what happened for these farmers?	
14. During the time you have used drip irrigation, did you face any challenges? Yes or no, can you please explain your response?		
15. TOMAK has supported a 50% cost-share arrangement to purchase drip irrigation, going forward what is your plan if TOMAK no longer provides this support?		
16. Based on your experiences using drip irrigation, do you have any recommendations for other farmers?		



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