

# A Socio-economic Evaluation of AI-Com Low Labour Mung-bean System



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*Report Cover Photo: A Woman is picking up mung bean pods in Betano, on August 12, 2021.*

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## Executive summary

Low labour mung bean after rice is one of AI-Com's environmentally sustainable and low labour agricultural innovations. The low labour mung bean system was first tested in Manatuto Municipality in the administrative post of Natarbora through the Natarbora Agriculture Technical School and in Atabae (Migir) through MAF Directorate of Research in 2018. The treatment in the first trial focused on broadcasting mung bean into a standing rice crop at various times. This innovation was expanded to five on-farm trials in Natarbora in the second year. In that period, a farmer (*Sra. Juliana*) who participated in the trial suggested herbicide application before broadcasting mung bean which was integrated into this innovation (AI-Com 2019, p.9).

Over half of the surveyed farmers (N=17) previously planted mung bean conventionally by sowing in line or randomly by using a dibble stick on dry land area. In contrast, low labour mung bean is planted using a dibble stick, an injector or by broadcasting on rice paddy field. Broadcasting mung bean on fallow or an abandoned rice field is a completely new method for all participating farmers in the target locations. The main benefits identified by surveyed low labour mung bean farmers were that the innovation provided a source of income (36%), mung beans are high in nutritional value (18%) and improved soil fertility (16%). A common challenge farmers faced across all three periods was pest invasion. The average mung bean productivity obtained was 0.8 t/ha with no significant difference between herbicide users (0.7 t/ha) and non-users (0.9 t/ha). Most farmers wanted to continue applying this innovation, particularly since the market value for mung bean (USD\$0.75/kg-USD\$1.75/kg) is higher than maize (USD\$0.30/kg).

The gross margin analysis indicates that the gross income obtained from low labour mung bean system (no tillage) is higher (USD\$509/ha) than using traditional method or tillage (USD\$418/ha). Furthermore, the labour analysis indicated that the low labour mung bean innovation helps save working time for both men and women. Compared to the conventional method which requires ploughing for weed control before planting, using herbicide and planting with a dibble stick helps to reduce 13 working days for men and 18 working days for women per hectare of land. When using herbicide and broadcasting, it reduces 22 working days for men and 38 working days for women. It also increases the dollar return on labour from USD\$4.00/day to USD\$8.00/day when planting using dibble stick and to USD\$15.00/day when broadcasting. Since our findings show that men took charge of herbicide application because the sprayer tanks were considered too heavy by women, providing alternative, physically less demanding technologies for herbicide application can lessen the work burden for men and

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empower women who face labour concerns.

Herbicide application helps farmers to reduce energy expended in the field and the cost for hire labour for weed control and most of the recommendations given by surveyed farmers was to continue to support them with herbicide. As highlighted above, no significant difference in production was recorded between herbicide users and non-users; nonetheless, herbicide application increases production per labour day. Considering herbicide application is an important aspect of this innovation to reduce labour expenditure for men and women, hence, in addition to considering alternative technologies to the sprayer tank which can lighten labour burdens, we recommend that training on appropriate use and safe handling of herbicide should continue (e.g., AI-Com and MAF regularly share information on appropriate herbicide application and safe handling during Field Days and before innovations are implemented).

Men and women hold different roles in household agricultural production and taking a gender perspective can ensure pre-existing inequalities within households are not deepened, improve crop production and also the long-term adoption of innovations. Most respondents indicated that both heads of households were jointly involved in deciding to implement the low labour mung bean system (77%). They responded similarly in terms of decision making on mung bean sale (65%) and the use of income derived (68%). These findings, together with the gendered labour roles (e.g., men were responsible for herbicide application while women took charge of carrying, drying and threshing mung bean), suggest men and women are inter-dependent in implementing the low labour mung bean system.

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## I. Introduction

Mung bean (*Vigna radiata* (L). Wilczek) is a hardy early-maturing legume that can be grown simultaneously with, or between successive plantings of a main crop (Rani *et al.* 2018). Legumes serve important functions; first, at the food-system level as a source of plant proteins with nutritional benefits for humans and feed stock. Second, at the production-system level, legumes fix atmospheric nitrogen, making them environmentally friendly in low-input systems through the regeneration of nutrient-deficient soils and to produce high-yielding crops. Third, at the cropping-system level, legumes promote crop diversification when planted in rotation with non-leguminous crops, which also breaks the cycles of pests and diseases (Yuvaraj, Pandiyan and Gayathri 2020). In South Asia, mung bean is particularly attractive for farmers because of its short planting duration and performance under adverse climatic conditions such as heat, drought and salinity (HanumanthaRao, Nair & Nayyar 2016).

Low labour mung bean after rice is one of AI-Com's environmentally sustainable and low labour agricultural innovations. The first rice planting season in Timor-Leste is from December through to March and the second planting season is between June and August. September to November is the short dry season when the rice field is typically left fallow (Seeds of Life 2010, pp.26-29). During this period, the fields are also used for grazing cattle and other livestock. Land preparation for the next cropping season involves tillage or slash and burn techniques to remove rice stubble and weeds. These techniques are labour intensive and environmentally destructive with the field becoming less fertile in a couple of years.

By planting mung bean in the same field after rice during the short dry season, soil fertility can improve over time as discussed above through the process of nitrogen fixation. Farmers can also make use of land in irrigated areas with low water availability in the dry season or second cropping season, replace rice or maize cultivation in areas where water is insufficient during the main cropping seasons or bring abandoned rice fields into productive use due to insufficient water or poor irrigation (AI-Com 2021a). AI-Com's innovation low labour mung bean system, draws on the principle that farmers will spend less time working in the field but their production per labour day will increase (AI-Com 2021a). By applying herbicide on rice fields, farmers can prepare land for planting, and reduce weed control, which involves hand pulling or hand hoeing (Verma and Kushwala 2019). Manual weed control is typically performed by women and effective and safe herbicide application may help to prevent weeds while saving women time and reducing their workload. Applying herbicide before planting, followed by the rapid growth of mung bean means that there is minimal need for weeding during the growing period since the mung bean plant spreads to cover the ground thereby suppressing weeds, with

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the added benefit of providing mulch cover and reduce soil evaporation (AI-Com 2021a). Applying herbicide also contributes to effective land utilisation instead of leaving it unused since farmers can diversify crop production without ploughing, improve food security and potentially gain a supplementary income.

Three planting methods are used in low labour mung bean cultivation: broadcasting, planting using a dibble stick or using an injector (originally used to plant maize but MAF researchers modified the machine to plant mung bean). Each of these planting methods has its benefits and disadvantages. Farmers decide which method they want to apply, depending on their local conditions (AI-Com 2021a). Broadcasting saves farmers time, labour and money (if they have to hire labour). Nonetheless, this method sometimes requires more seeds (30kg/ha compared to 20 kg/ha). When planting mung bean using a dibble stick, farmers can save on seeds, but they may expend more time, labour and/or money to pay for hired labour for planting. Planting using an injector helps farmers to plant in line, use less labour and save time but since the injector was originally developed to plant maize, the size of the hole is inappropriate for mung bean grain. Therefore, sometimes mung bean seeds spill out when the injector has not been well modified. In addition, the machine itself is very limited in supply. Only a few farmers, such as those involved in farming groups can have access to the injector (Betano Research Center, *pers comm.* 17 June 2021).

The low labour mung bean system was first tested in Manatuto Municipality in the administrative post of Natarbora through the Natarbora Agriculture Technical School and in Atabae (Migir) through MAF Directorate of Research in 2018. The treatment in the first trial focused on broadcasting mung bean into a standing rice crop at various times. This innovation was expanded to five on-farm trials in Natarbora in the second year. In that period, a farmer (*Sra. Juliana*) who participated in the trial suggested herbicide application before broadcasting mung bean which was integrated into this innovation (AI-Com 2019, p.9).

Broadcasting mung bean after rice was then expanded to a larger field in Natarbora (Manatuto Municipality) as well as Betano and Same in Manufahi Municipality in the third year. The innovation was named low labour mung bean system since AI-Com and partners, together with farmers, started to trial mung bean on rice field and dry land with two planting methods – broadcasting and planting using a dibble stick (AI-Com 2020, p.17). The dollar return on labour has been recorded higher for broadcasting, increasing from USD\$4-USD\$5/day with conventional production to more than USD\$10/day with broadcasting mung bean after rice (AI-Com 2021, pp.3-4).

The adoption of low labour mung bean system continued to expand dramatically in Manufahi due to rice farmers wanting to overcome low water availability during the second planting

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season which prevented them from planting a second rice crop. After successful demonstrations of low input mung bean production (3ha in Betano-Same and 26ha in Fatuberlihu), the Manufahi Administrator requested scaling up this agronomic innovation. Since then, an area of 140ha of mung bean was planted by June 2021 in the municipality (AI-Com 2021, pp.3-4). AI-Com and the MAF-Directorate of Research continued to expand the innovation in Bobonaro and Viqueque in 2021.

Based on field observations, all farmers who have adopted the low labour mung bean system have grown mung bean in rice fields, except in Manufahi Municipality, where some farmers have applied the low labour mung bean system by making use of dry land area with underground water or rice fields that were previously used to plant dryland crops, such as maize or dryland rice due to broken irrigation.

This low labour mung bean evaluation was conducted on the south coast in Manatuto and Manufahi Municipalities where the innovation was introduced since 2018 and 2020. Between 14-19 February 2022, AI-Com's SOSEK team conducted the evaluation with the objectives to understand farmers' knowledge, perceptions and practices in applying the low labour mung bean system under these varying field conditions and locations.

## **II. Objectives**

The main objectives of this evaluation were to:

- 1) Document farmer knowledge on implementing the low labour mung bean system.
- 2) Describe farmers' perceptions of the benefits and disadvantages of low labour mung bean system.
- 3) Understand farmers' practices in applying this low labour agriculture innovation, with particular attention on labour expenditure for weeding and gendered workloads as compared to conventional methods of planting mung bean.

## **III. Methodology**

### **3.1 Methods used**

A mixed methods approach was used in this study. The methods employed comprised a household (HH) questionnaire and focus group discussions (FGDs) with separate men's and women's groups.

### 3.2 Target locations and participants

Since 2018, AI-Com and partners introduced the low labour mung bean system in four municipalities, starting in Manatuto, expanding into Manufahi, Bobonaro and Viqueque. The target locations selected for this evaluation were where the low labour mung bean system has been trialled more than once by farmers. Therefore, only two municipalities were selected. Firstly in Manatuto, Aubeon village (Natarbora Administrative Post) was selected. Secondly in Manufahi, Betano village (Administrative Post of Same), Uma Berloik village (Alas Administrative Post), along with Fatukahi and Clacuc villages (Fatuberlihu Administrative Post) were chosen.

The target participants for this survey were farmers who have adopted the low labour mung bean system. Based on the list obtained from MAF Researchers responsible for implementing this activity, a 20% sample size of the total low labour mung bean farmers was taken for the questionnaire. As summarised in Table 1, a total of 31 participants were surveyed for the HH questionnaire. The highest number of respondents (N=11) came from Betano village since it has the highest number of low labour mung bean farmers, followed by Fatukahi village (N=8) and others. Although four to five participants were targeted for each FGD, a higher level of participation was obtained (N=13 in Betano and N=16 in Fatukahi). FGDs were conducted separately with additional men and women who were not sampled in the HH survey to get a gender perspective on labour expenditures and responsibilities in the conventional and the new methods of mung bean production.

**Table 1 Total HH questionnaire and FGD participants in the low labour mung bean evaluation.**

Adm. Post	Village	Household Questionnaire			FDG Activity		
		Women	Men	Total Participants for HH questionnaire	Women	Men	Total participants for FDG Activity
Same	Betano	5	6	11	4	9	13
Alas	Uma Berloik	4	2	6	-	-	-
Fatuberlihu	Clacuc	2	2	4	-	-	-
	Fatukahi	2	6	8	6	10	16
Natarbora	Aubeon	1	1	2	-	-	-
<b>Overall</b>		<b>14</b>	<b>17</b>	<b>31</b>	<b>10</b>	<b>19</b>	<b>29</b>
<b>Total participants for HH questionnaire and FGD activity</b>				<b>60</b>			



Figure 1 Focus group discussion activity held in Fatukahi, Fatuberlihu, on February 18, 2022.



Figure 2 Household survey in Alas, on February 16, 2022.

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## IV. Results

### 4.1 Demographic data

#### 4.1.1 Total respondents in HH questionnaire

A total of 31 respondents participated in the questionnaire, with almost a gender balance in the number of men (N=17) and women (N=14) farmers. In Betano village, the rice fields are located in one area but the farmers came from different hamlets (sub-village) to work on their rice field or to access other people's fields (Table 2).

Table 2 Total respondents obtained in the household survey sorted by hamlet and gender.

Municipality	Adm. Post	Village	Hamlet	Women	Men	Total
Manufahi	Same	Betano	Bemetan	3	3	6
			Leo-ai		1	1
			Raifusa		1	1
			Selihasan		1	1
			Sesurai	2		2
	Alas	Uma Berloik	Baria-Laran	1		1
			Uma-Ferik	3	2	5
	Fatuberlihu	Clacuc	Tiro	2	2	4
		Fatukahi	Fatuboe	2	6	8
	Manatuto	Natarbora	Aubeon	Bubur-Laran	1	1
<b>Total Participants for HH survey</b>				<b>14</b>	<b>17</b>	<b>31</b>

#### 4.1.2 Respondents' age and marital status

Of the 31 respondents, the minimum age was 27 and the maximum was 71. Most respondents were married (N=30) and one in Fatukahi village was a widower.

#### 4.1.3 Respondents' education and main job

Twenty-six respondents (14 men and 12 women) previously attended school. Of these respondents, 11 respondents (8 men and 3 women) completed Primary school, five (1 man and 4 women) completed Junior High school, nine (5 men and 4 women) completed Senior High school, and a woman respondent in Betano completed University; she stated that she was currently helping her husband in the farm since she has not gained another employment.

Almost all respondents stated their primary employment as farming (N=29, 15 men and 14 women) and they were working on their own land and obtained income from selling their farm produce. Two women farmers used other people's land to farm for free (no rent payment or sharing of harvest). The remaining two men respondents worked as public servants who earned monthly income.

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#### **4.1.4 Total household (HH) members**

The total number of HH members among respondents ranged from two to 16, with the total number of adults in each HH ranging from two to eight and the total number of children ranged from one to nine. Five households contained no children.

#### **4.1.5 Remittances and government social transfers**

Only four respondents stated “yes” to receiving remittances from family members who worked in other places. In addition, most respondents did not benefit from government social transfers (N=19). Respondents who received government pensions included aged pension (N=7), *bolsa da mae* (N=4) and veteran pension (N=1).

#### **4.2 Previous experience cultivating mung bean**

Prior to the adoption of the low labour innovation, 17 (9 men and 8 women) respondents previously planted mung bean (Table 3). In this cohort, all respondents had planted on dry land (N=17) by planting in line (N=16) or randomly (N=1) using a dibble stick. Most of these respondents could not recall the exact year they started to cultivate mung bean, stating “since a long time ago” (N=7), since the Indonesian occupation between 1975 and 1999 (N=4), before 2010 (N=3) and after 2010 (N=3). Most respondents stopped planting mung bean using the conventional method in 2020 (N=7), two respondents stopped in 2019, one in 2017 and another one in 2016. The remaining six respondents continued to plant mung bean using the old method until the last planting season in 2021 and will continue to plant again on dry land in the next cropping season, in addition to their trial on rice field using the low labour mung bean system.

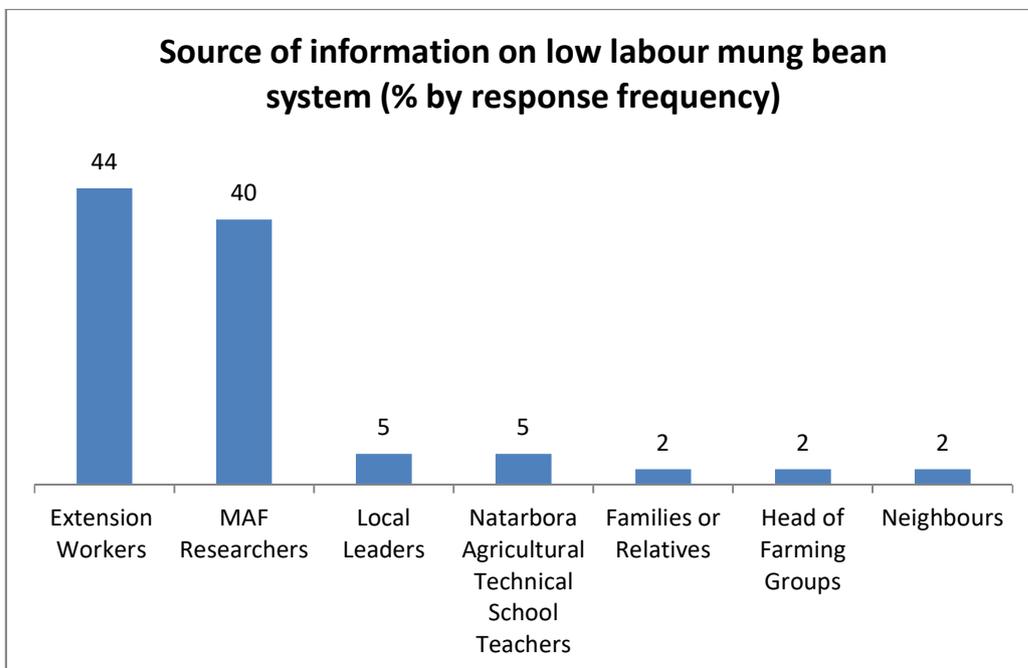
**Table 3 Farmers' previous experience planting mung bean.**

Have you ever planted mung bean prior to planting with low labour mung bean innovation?				
Village	Gender	Yes	No	Total respondents
Betano	Women	1	4	5
	Men	4	2	6
Uma Berloik	Women	3	1	4
	Men		2	2
Clacuc	Women	1	1	2
	Men	1	1	2
Fatukahi	Women	2		2
	Men	4	2	6
Aubeon	Women	1		1
	Men		1	1
<b>Overall</b>		<b>17</b>	<b>14</b>	<b>31</b>

### 4.3 Planting with low labour mung bean system

#### 4.3.1 Sources of information

The main sources of information on how to implement low labour mung bean system was obtained from MAF extension (44%), MAF researchers (40%), local leaders (5%) and others as listed in Figure 3.



**Figure 3 Sources of information on low labour mung bean system (by response frequency (%)).**

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### 4.3.2 Inputs and sources of inputs

All farmers received small amounts of free mung bean seeds in the first year only. The main sources were from MAF researchers, extension workers, AI-Com, or the Natarbora Agriculture Technical School. The improved varieties of seeds used are Lakateu and Kiukai, which were both released by MAF as part of Seeds of Life. Apart from mung bean seeds, the main input used was herbicide (N=23). One respondent in Aubeon village also applied pesticide and another in Betano reported that they received mung bean seeds, herbicides and a hand sprayer from MAF for their first trial. Out of these 23 respondents, half (N=12) reported to purchase herbicides in the market (one respondent in Betano stated that received freely in their first trial but purchased in the market for their second season), 10 respondents have received free herbicides and pesticides from MAF researchers or extension workers and one respondent traded mung bean seeds with family in exchange for herbicide. Herbicides used by respondents were Roundup (360g/l Glyphosate in 10mL per litre of water), Polaris (Imazapyr (28.7%)) and Noxone (297 g/L Paraquate Dichloride). The price of herbicides ranged from USD\$8.00-USD\$12.00/L and are available in the local markets in Betano village and in Same market (the main town of Manufahi Municipality).

### 4.3.3 Planting methods

The three planting options were used by farmers for low labour mung beans. These options were broadcasting, planting in line by using a dibble stick or an injector. Only respondents in Betano reported trying all three methods. Respondents in Aubeon used two planting methods – planting in line by using dibble stick and broadcasting, while the others in Uma Berloik, Fatukahi and Clacuc villages only used one method – planting in line by using dibble stick. Overall, the highest percentage of farmers used planting in line with a dibble stick (66%), followed by broadcasting (19%) and using an injector (15%). The reasons for selecting a particular planting method are summarised in Table 4.



Figure 4 Mung bean plants on the rice field, planted in line by using dibble stick.

Table 4 Reasons for choosing each planting method for mung bean (by response frequency (%)).

Planting Method	Reasons for choosing a particular planting method	Gender		Total responses (%)
		Female	Male	
Sowing in line	Easy to remove weeds	47	23	34
	Birds and rodent will not eat all seeds	5	14	10
	Too many weeds in the field	5	9	7
	Gives better production	5	5	5
	Not used to broadcasting mung bean seed yet	0	9	5
	To re-sow if it does not grow	0	5	2
	The rice field is getting old	5	0	2
Broadcasting	Planted quickly	11	5	7
	Gives better production	5	5	5
	No labour	0	5	2
	No money	0	5	2
	Not require many labour	5	0	2
Using injector	Planted quickly	11	5	7
	No labour	0	5	2
	Not require many labour	0	5	2
	To reduce working time in the field	0	5	2

#### 4.3.4 Types of fields and water sources

Compared to the conventional method of planting mung bean on dry land, almost all respondents planted mung bean on rice fields in the low labour system (N=24). Of these 24 respondents, most of them planted mung bean in rotation with rice (N=23) and one planted on a previously abandoned rice field (N=1).

Among the seven respondents who planted mung bean on dry land, four used land that is locally termed in Tetum: *to'os rai matak*, referring to land that has shallow underground water. The remaining three respondents planted on rice fields used to plant maize or dry land rice since 2012 due to broken irrigation. This cohort comprised three farmers who had previously applied the conventional method prior to adopting this innovation.

More than 50% of respondents (N=17) in the five targeted villages relied on rain as their main source of water to implement the low labour mung bean system (Table 5). Nine respondents depended on river water diverted through a permanent irrigation canal, three respondents depended on springs (irrigation), one respondent on river water (irrigation) and another one used a small permanent irrigation system (called "*semi-irigasi*" in Indonesian) as their source of water.

Table 5 Planting field and source of water for farmers who planting mung bean using low labour mung bean system.

Village	Planting field	Rain-fed	Irrigation	Spring	River	Semi-irigasi	Total respondents
Aubeon	Rice field	1	1				2
Betano	Dry land	4					4
	Rice field		7				7
Clacuc	Dry land	3					3
	Rice field	1					1
Fatukahi	Rice field	4		3		1	8
Uma Berloik	Rice field	4	1		1		6
<b>Overall</b>		<b>17</b>	<b>9</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>31</b>

#### 4.3.5 Weed control

Weeding is usually performed by mechanical methods, such as tilling, hoeing, mulching, digging, burning and hand weeding or chemical methods, such as spraying with herbicides. According to FGD participants, weeding in the conventional method of mung bean cultivation is required more or less 2-4 weeks after sowing, and on average, it takes 10 days for men and 20 days for women to weed one sown hectare of land. Also, women reported more days for weeding since they are mainly responsible for this task (women FGD in Fatukahi, 18 February 2022).

Since the main advantage of the low labour mung bean system is to save farmers time to control weeds after a pre-plant application of herbicide, herbicide usage and time spent on weeding among respondents was examined. Respondents were divided into two categories, namely: 1) farmers who used herbicide (N=23) and 2) farmers who do not use herbicide (N=8). Among non-herbicide users, only one farmer did not control for weeds. In total, 13 respondents did not weed and 18 respondents who did (Table 6).

Table 6 Weeding based on herbicide application.

Herbicides application and weeding	Aubeon	Betano	Clacuc	Fatukahi	Uma Berloik	Total respondents
Use herbicides and no weeding	1	5	1	4	1	12
Use herbicides and do weeding	1	3		4	3	11
No herbicides and do weeding		3	3		1	7
No herbicides and no weeding					1	1
<b>Overall</b>	<b>2</b>	<b>11</b>	<b>4</b>	<b>8</b>	<b>6</b>	<b>31</b>

Of the 13 respondents who did not do weeding (used herbicide and no weeding (N=12) and no herbicide and no weeding (N=1)), their reasons were mostly because herbicide prevented weeds and mung beans leaves also suppressed weed growth, as summarized in Table 7. These views were echoed among FGD participants who sprayed their land with herbicide before planting and stated that they spent no time and labour for weeding (Men and women FGD in Betano and Fatukahi, 15 and 18 February 2022).

**Table 7 Reasons for no weed control.**

<b>Herbicides application and weeding</b>	<b>Reasons for not weeding</b>	<b>Total respondents</b>
Use herbicides and no weeding	Sprayed with herbicide	6
	Mung bean leaves covered the ground	4
	No weeds	1
	Planted late and no production	1
No herbicides and no weeding	Planted late and no production	1
<b>Overall</b>		<b>13</b>

As Table 8 shows, out of the 18 respondents who did weeding, those who applied herbicide (N=11) required between five to 10 days in total for weed control, a large reduction as compared to the conventional method, as described in Section 4.4. Some respondents explained that they went to the field approximately 1 or 2 days per week to monitor the crops and pull out the weeds by hand, if there were any. One respondent who grew mung bean on dry land explained that they need to remove weeds even though they applied herbicide before planting since their land is located on the flat area. Therefore, when the rain comes, it will bring the weed seeds from upland areas downhill onto their land and thrive. On the other hand, respondents who did not apply herbicides spent more days for weeding. Some of these farmers also ploughed their land before planting mung bean due to dense weed growth.

**Table 8 Total working days and weeding labour based on herbicide application.**

Herbicide usage and weeding	Total Labour (men and women)	Size of land (ha)	Total working days			Total respondents
			5-10 days	15-20 days	25-30 days	
Using herbicides and weeding	0M-1F	0.25	1			1
	1M-1F	0.25	4			4
	1M-1F	0.6	2			2
	1M-1F	1	1			1
	2M-1F	0.5	1			1
	2M-1F	1	1			1
	5M-0F	1	1			1
No herbicides and do weeding	0M-4F	0.5			1	1
	1M-3F	0.25		1		1
	1M-5F	0.5		1		1
	2M-3F	0.5		1		1
	3M-1F	1			1	1
	3M-2F	0.3		1		1
	5M-5F	0.5		1		1
<b>Overall</b>	<b>31M and 33F</b>	<b>8.15</b>	<b>11</b>	<b>5</b>	<b>2</b>	<b>18</b>

Although the cultivation fields varied in size (ranging between 0.25-1 ha), the total number of farm labour required for weeding was between one to five workers and mostly performed by both men and women (Table 8). Labour for weeding is mostly undertaken by family members (N=16 out of 18 respondents who did weeding). Only one respondent, who did not use herbicide, relied on farming group members in addition to family members and another respondent use family labour as well as hired paid labour. No cash payment was involved when farming group members provided labour, as it is based on mutual cooperation, working in rotation on each member’s farm. The landowner typically provides meals for the workers. Paid labour is hired on a daily wage basis and the respondent who hired labour paid USD\$3.00/day per worker.

#### 4.3.6 Mung bean harvest

Of the total sample, 21 respondents successfully harvested mung bean in the last year (Table 9). Those who did not have a successful crop (N=10) cited various reasons, including planted during the rainy season and therefore crop was destroyed by rain or have not harvested yet (N=8). Two growers who planted during the dry season (Sep-Nov) were unable to harvest because of animal destruction (N=2).

For mung bean harvest all respondents relied on family labour. Two respondents drew on additional labour, such as farming group members (N=1) and paid labour (N=1).

**Table 9 Total respondents who were able and not able to harvest mung bean based on herbicide application and weeding.**

Herbicides application and weeding	Harvested mung bean	Did not harvest mung bean	Reasons for no harvest	Total Respondents
No herbicides and do weeding	6	1	Have not harvested yet	7
No herbicides and no weeding		1	Planted late and therefore no production	1
Use herbicides and do weeding	7	4	Have not harvested yet (N=2) No production obtained (N=2)	11
Use herbicides and no weeding	8	4	Destroyed by animals (N=2) Planted late and no production (N=1) Have not harvest yet (N=1)	12
<b>Overall</b>	<b>21</b>	<b>10</b>	<b>N=10</b>	<b>31</b>

The average reported productivity was 0.8 t/ha (minimum was 0.4 t/ha and the maximum 1.5 t/ha). As shown in Table 10, the average productivity of respondents who did not use herbicide (0.8 t/ha) showed no significance difference to those who used herbicide (0.9 and 0.7 t/ha) suggesting that the productivity is independent of land preparation techniques, such as using herbicide or ploughing before planting.

**Table 10 The average production based on group category.**

Groups category	Count	Average Production (t/ha)
Use herbicide and no weeding	8	0.9
Use herbicide and do weeding	7	0.7
No herbicide and do weeding	6	0.8
No herbicide and no weeding	1	-
<i>P-value</i>		0.29(NS)

#### 4.3.7 Income from mung bean sale

Of the 21 respondents who harvested their mung bean, 17 respondents sold their produce. Those who did not sell mung bean only obtained enough for consuming or shared with family and relatives and therefore the production was only enough for household consumption. Respondents who sold mung bean sold from their homes to buyers that came from Dili, Same or Viqueque. The price ranged between USD\$0.75/kg-USD\$1.75/kg. One respondent sold up to 300 kg and earned USD \$450.00. This respondent planted mung bean on 1 ha of land during the second planting season (June-Aug) and the total production obtained was 800 kg (0.8 t/ha).

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Additional data on mung bean prices and farmer earnings in Fatukahi can be found in Appendix 1 (Table 16).

#### **4.3.8 Sharing knowledge on low labour mung bean system with other farmers**

Twenty out of the total respondents have shared their knowledge on the low labour mung bean system with their peers. Among them, 40% of respondents reported that farmers who obtained information from them have started to trial the innovation, 35% of respondents stated that the farmers they shared their knowledge with have not trialled yet, 20% of respondents stated that the farmers they shared with will try the innovation in the upcoming cropping season and 5% could not try because they did not have any mung bean seeds.

#### **4.4 Labour activities in the low labour mung bean system**

FGD participants described the labour activities involved in the low labour mung bean system as follows: 1) prepare the rice field by spraying weeds and the previous season's rice stubble with herbicide, 2) plant/broadcast mung bean, 3) weed control, 4) harvesting (drying, threshing, and cleaning mung bean to remove broken/unused seeds), and 5) selling. Tables 17 and 18 in Appendices 2 and 3 detail labour activities performed by men and women based on the data obtained from the FGDs.

In conventional mung bean production, planting, weeding and harvesting mung bean were tasks performed by women, however, in the new system, men also plant, remove weeds and harvest when they have no workers or no money to hire labour. Spraying herbicide is considered men's work since the sprayer tank is too heavy for women. This is also one of the reasons why men and women heads of HH need to agree to grow mung bean, otherwise women would face difficulties in herbicide application if they solely decided alone (women's FGD group, Betano, 15/02/2022). Additionally, cleaning seeds continues to be considered as a women's task, as men do not know how to use wide shallow basket to clean mung bean (FGD activity in Betano (15 February 2022) and Fatukahi (18 February 2022)). (Tables 17 and 18).

Low labour mung bean innovation helps to increase farmers' income, return per labour working days (USD\$/labour days) and help to save working time for both men and women. Drawing on gross margin analysis, Table 11 indicates that the gross income obtained from low labour mung bean system (no tillage) is higher (USD\$509/ha) than using traditional method or tillage (USD\$418/ha).

**Table 11** Gross income, expenses and gross margin for mung bean production based on land preparation type (tillage and no tillage) and planting method (dibble stick and broadcasting).

Items	Tillage and planting with dibble stick	No tillage and planting with dibble stick	No tillage and broadcasting
<b>Income</b>			
Productivity (kg/ha)	730	765	765
Price (\$/kg)	0.75	0.75	0.75
<b>Gross income (\$/ha)</b>	<b>548</b>	<b>574</b>	<b>574</b>
<b>Cash expenses (\$/ha)</b>			
Seed (\$/ha)	20	20	20
Tractor (\$/ha)	110	0	0
Herbicide (\$/ha)	0	45	45
<b>Total cash expenses (\$/ha)</b>	<b>130</b>	<b>65</b>	<b>65</b>
<b>Gross margin/ (\$/ha)</b>	<b>418</b>	<b>509</b>	<b>509</b>

Additionally, the labour analysis result in Table 12 shows that compared to the old method which requires ploughing before planting mung bean (tillage), applying herbicide (no tillage) and using a dibble stick to plant help to reduce 13 working days for men and 18 working days for women per hectare of land cultivated. When herbicide and broadcasting are applied in combination, it reduces 22 working days for men and especially for women, it reduces up to 38 working days.

**Table 12** Labour days reduced from using low labour mung bean system for men and women (total labour days/ha).

Gender	Total Labour days/ha		
	Tillage and planting with dibble stick	No tillage and planting with dibble stick	No tillage and broadcasting
Men	45	32	23
Women	55	37	17
Total	101	68	39
<b>Reduction of days when using low labour mung bean system (days/ha)</b>			
Men	0	13	22
Women	0	18	38
Total	0	31	60

Low labour mung bean system (no tillage) helps to save working days, which increases the dollar return per labour days as shown in Table 13.

**Table 13 Labour days required and dollar returns on labour per activities for mung bean production based on land preparation type (tillage and no tillage) and planting method (dibble stick and broadcasting).**

Activity (days/ha)	Tillage and planting with dibble stick	No tillage and planting with dibble stick	No tillage and broadcasting
Cleaning grass/burning	10	0	0
Fencing	5	5	5
Ploughing (tractor)	2	0	0
Planting	30	30	1
Weeding	30	2	2
Spraying chemicals	0	2	2
Harvesting	14.6	15.3	15
Drying	2	2	2
Shelling / cleaning	7	7	7
Marketing	0	0	0
Transporting	0	0	0
Other crop management	0	0	0
<b>Total labour days/ha</b>	<b>101</b>	<b>63</b>	<b>34</b>
<b>Return (\$/labour day)</b>	<b>4</b>	<b>8</b>	<b>15</b>

## 4.5 Farmer perceptions on low labour mung bean system

### 4.5.1 The benefits

Almost all men and women respondents perceived the main benefit of implementing the low labour mung bean system to be able to sell mung bean to increase family income and use the income to meet family needs, such as building or repairing housing, pay for children's school fees and others (36%) (Table 14). Another benefit reported was the nutritional value of mung bean (18%). Respondents also highlighted specifically that mung bean is nutritious for children. The third benefit emphasized was that planting mung bean improved soil fertility (16%), among others.

Table 14 The benefits of implementing low labour mung bean system.

The benefits of implementing low labour mung bean system	Women	Men	Response Frequency (%)
Sell and get money	36	36	36
Improve family nutrition	14	23	18
Improve soil fertility	14	18	16
Have a good price in the market	23	5	14
Able to save time and energy	5	9	7
Share with family/relatives	9	0	5
Easy to carry as it is lighter than maize	0	5	2
The income obtained is higher than maize	0	5	2

Benefits as explained by respondents are cited below:

*“Mung bean improves soil fertility as rice planted after mung bean their leaves [rice] are green or look fertile but on the rice field that we did not rotate with mung bean, the leaves turned yellow or look unfertile”* - Respondent from Aubeon village who had planted mung bean after rice since 2018

*“We do not feel tired of planting because we only broadcast mung bean seeds. The important thing is we need to broadcast right after rain and after the seeds germinated, we need to remove mung bean plants that grow too dense”* – Respondent from Betano who started to implement low labour mung bean system in June 2021 (Dry season).

*“We like to implement low labour mung bean because we just broadcast the seed therefore, we do not get tired and it is quickly sold out in the market”* – A woman respondent from Betano who implemented the low labour mung bean system from June 2021 (Dry season).

*“Obtained income, add to family nutrition and it improves soil fertility, but we have not rotated with rice yet”* – A woman respondent from Betano who have started to implement low labour mung bean system since dry season 2021.

*“We were able to obtain money and food within a very short time, add to family nutrition and MAF researchers also advised us to grow mung bean in the unused or unfertile land to improve soil fertility”* – Respondent in Betano who started to implement low labour mung bean system in June 2021.

*“Satisfactory income. Planting and weeding are very tiring work but it is lighter to carry compared with maize”* – Respondent from Clacuc who trialled low labour mung system in dry season 2021 and did not use herbicide.

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#### 4.5.2 Challenges faced during the dry and wet seasons

This section on challenges faced in implementing the low labour mung bean system is presented according to the most recent planting periods for mung bean, beginning with the second planting season in 2021 from June-August (N=20), followed by the short dry season between Sep-Nov (N=8) and the first planting season of 2022 starting in Nov/Dec 2021-Jan 2022 (N=13). The total number of respondents is more than 31 because some farmers grew mung bean in the second planting season and once again in either the dry season period or the first planting season for 2022.

All surveyed farmers who planted during the 2021 second planting season reported pest attacks as their main challenge (100%). Respondents who planted during the dry season (Sep-Nov) faced problems with animal destruction (cattle and birds) (71%). Additionally, those who planted during the 2022 first planting season reported that the mung bean plants were unable to produce fruits as the heavy rain destroyed all flowers and as a result, mung bean plants produced more leaves than fruits (50%), were attacked by pest (30%) or that they failed to harvest because they planted late for the season (20%) (Figure 5). Respondents who did not apply herbicide recognized that weeding was one of the challenges they faced. Harvesting was another tiring activity since almost all farmers harvested mung bean manually by hand or chopped the plants with a machete or knife. Additionally, a respondent experienced an unexpected fire that burnt the small shelter used for seed storage where they had stored 300kg of mung bean seeds.

Some challenges as described by respondents are cited below:

*“We wanted to continue planting mung bean after harvesting rice that was planted in the second planting season but there are animals that roam freely in the rice field area because farmers like to let their animals graze temporarily in the rice field during this period” –*  
Respondent who trialled mung bean during the dry season 2021 in Betano.

*“We planted during the rainy season, therefore the rain destroyed all the flowers which made the mung bean plants have more leaves than fruits” -* Respondent who trialled mung bean for the first time during wet season 2021 in Uma Berloik village.

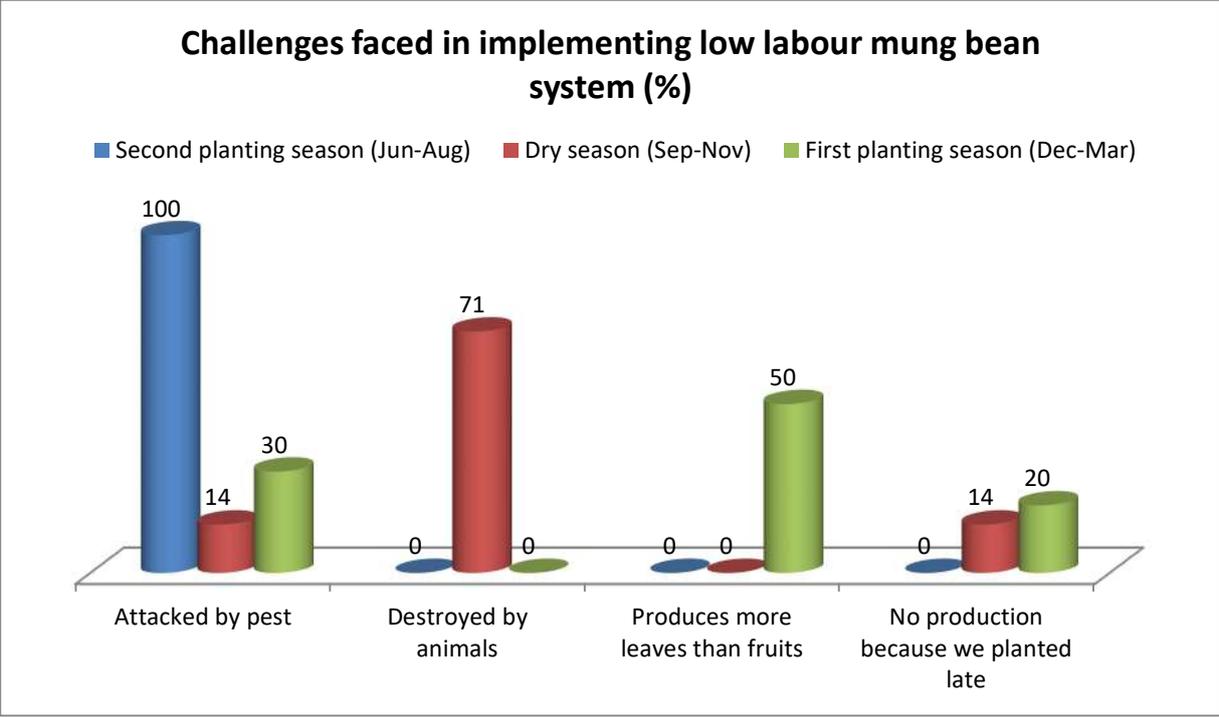


Figure 5 Challenges faced by respondents sorted by planting season.

#### 4.6 Decision making in the family

As shown in Figure 6, cultivating mung bean was mostly decided jointly by men and women HH heads (77%). Ten percent of respondents stated that the decision was made by men heads of HH and six respondents stated that the decision was made by women head of HH. Three percent of respondents planted mung bean because it was recommended by their local leaders (heads of hamlet and village) and another three percent grow mung bean because the extension workers and the head of their farming group recommended. Figure 6 presents household decision making to implement the low labour mung bean system sorted by respondent’s gender.

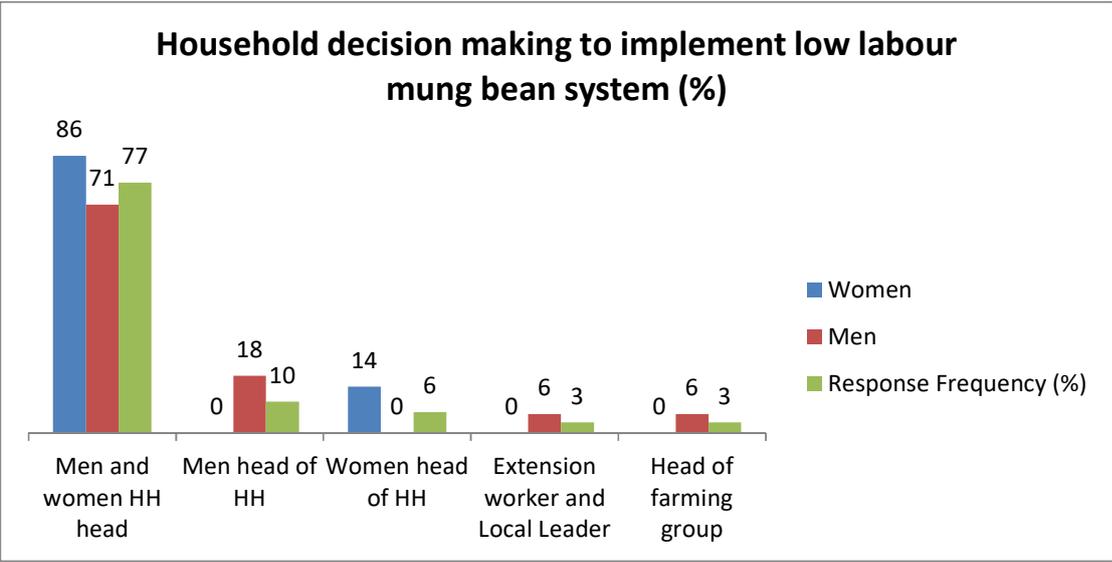


Figure 6 Household decisions making to implement low labour mung bean system.

Similar to decision-making on growing mung bean, the decision to sell mung bean and how the income derived from mung bean sale is used were mostly reported to be jointly made by both men and women HH heads (65% and 68% respectively). A few respondents did not respond to this question as they had not sold their mung bean product, had not yet harvested or failed to harvest.

#### 4.7 Future plans

Out of the total sample, 30 respondents wanted to plant mung bean again in the future even without support from AI-Com and MAF. The most cited reason was because mung bean has a good price in the market and they wanted supplementary income. A respondent in Fatukahi did not want to continue planting because the respondent is getting old and has insufficient strength to do many tasks at the same time.

#### 4.8 Questions and recommendations for MAF and AI-Com

Respondents were given the opportunity to ask questions regarding the low labour mung bean system at the end of their interview. The two questions posed to the research team were “can you help us with providing herbicides?” and “could you come to visit us regularly once or twice a week to see the progress?”. Nonetheless, more than half of the respondents gave recommendations. Most recommendations were similarly related to seeking support, specifically for herbicides, tractors, seeds and barbed wire for fencing, as listed in Table 15. The requests for tractors came from respondents who did not receive herbicides and where on the south coast, weeds grow fast and too dense. Therefore, farmers cannot grow any crops without

ploughing with a tractor, unless they sprayed with herbicide. Some respondents would like to continue implementing the low labour mung bean system in the next cropping season as the retail price of mung bean was better than maize (mung bean: USD\$1.25/kg and maize: USD\$0.30/kg).

**Table 15 Recommendations given by respondents to MAF or AI-Com.**

<b>Village</b>	<b>Recommendations given to MAF or AI-Com</b>
Betano	<i>Visit our site to understand the progress and problems that we faced at least once or twice a week.</i>
Betano	<i>We are happy because we have learnt new technology on broadcasting mung bean seeds. This is really new for us. Even old farmers were surprised by this innovation as we never broadcast mung bean before. Not only that, the price is also better than maize. Maize was sold for \$0.30/kg and mung bean was sold with \$1.25/kg. If possible, continue implementing it and adding other products as well, like zucchini.</i>
Betano	<i>We need herbicides. We need more than one bottle because we do not spray only the rice field, but we need to spray also to the rice-field bund.</i>
Betano	<i>We need seeds, pesticide and herbicide.</i>
Clacuc	<i>If possible the state (Estadu) sends the tractor earlier, so that we can plant on time. Also, send some technician to fix the tractor because it cannot operate well. It gets broken often.</i>
Clacuc	<i>We face problem with tractor. Government tractors were all broken. We seize the tractor when it comes to land preparation time. We need to plough our land because the weeds grow too fast and too much.</i>
Clacuc	<i>We have land but cannot plant anything because the tractors were all broken.</i>
Clacuc	<i>We want to plant but we always run out of the planting season because the tractor came late. If possible, the Government send the tractor earlier so that we can be able to plant on time.</i>
Clacuc	<i>We would like to continue implementing low labour mung bean system if you provide the seeds.</i>
Fatukahi	<i>The biggest problem that we face is animals which still roam freely. Therefore we need barbed wire to build a fence around our farming area.</i>
Fatukahi	<i>The seeds must arrive on time.</i>
Fatukahi	<i>We are happy to learn new technology about mung bean. However, we still lack of many things like pesticides, herbicides and have problem with lack of water.</i>
Fatukahi	<i>We need herbicides.</i>
Uma Berloik	<i>I do not have money to buy herbicides, especially when planting too late. Kindly help me with herbicides like Polaris or Round up.</i>
Uma Berloik	<i>Please continue to support us - The common people.</i>
Uma Berloik	<i>We need tractor to plough the land, as every year we rent other people's tractor to plough the land and the cost is \$50.00/day.</i>

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## V. Discussion and Conclusion

Over half of the surveyed farmers (N=17) previously planted mung bean conventionally by sowing in line or randomly by using a dibble stick on dry land area. In contrast, low labour mung bean is planted using a dibble stick, an injector or by broadcasting on rice paddy fields. Broadcasting mung bean on fallow or an abandoned rice field is a completely new method for all participating farmers in the target locations. As a legume plant, mung bean contributes to soil conservation and when rotated with other main crops, can yield well with minimal inputs (FAO 2016). The main benefits identified by surveyed low labour mung bean farmers were that the innovation provided a source of income (36%), mung beans are high in nutritional value (18%) and improved soil fertility (16%).

Farmers on the south coast face several constraints to increase their crop production. SOSEK team found in a previous survey that the greatest constraint to cropping during the short dry season is livestock destruction of crops (AI-Com SOSEK report 2020). The findings from this survey also shows that farmers who planted mung bean during this period between September and November failed to obtain a harvest due to animal destruction and sudden rainfall. Likewise, those who planted during the first planting season (Dec-Mar) failed to harvest their crop due to many challenges, such as no rain or too much rain, which destroyed the mung bean plants or the mung bean plants grew well but did not produce many seeds as the rain destroyed all the flowers. Nonetheless, farmers stated that their main reason to plant mung bean out of its ideal planting season was to improve soil fertility, instead of leaving their rice field unused since the irrigation channel was not working. A common challenge farmers faced across all three periods was pest invasion. Although broadcasting requires fewer working days and fetches a higher dollar return per labour day as compared to planting using a dibble stick, farmers who broadcast by hand explained that birds often ate the seeds since they are on the soil surface. Therefore, farmers considered using a dibble stick for planting as the best option since this method makes it easier to protect their seeds from birds and remove weeds.

Farmers who obtained a high production and income from mung bean were those who planted mung bean in the second rice planting season (between June-August). They had no problems with animal destruction since rice farmers let their cattle graze on the uplands rather than on the lowlands during this period. The average mung bean productivity obtained was 0.8 t/ha with no significant difference between herbicide users (0.7 t/ha) and non-users (0.9 t/ha). This finding supports AI-Com and UNTL's previous research on conservation agriculture (CA) which tested four different land preparation types for mung bean cultivation and the resulting productivity did not show any significant difference among the treatments (The 6<sup>th</sup> phase seminar held in UNTL, 28 March, 2022). The treatments used for land preparation using CA

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were 1) no slash and burn, no ploughing and spray with herbicide, 2) no ploughing but use slash and burn 3) no slash and burn but ploughing and 4) control (no slash and burn, ploughing or spray with herbicide).

Most farmers wanted to continue applying this innovation, particularly since the price is higher for mung bean (USD\$0.75/kg-USD\$1.75/kg) than maize (USD\$0.30/kg). The high demand for mung bean is further demonstrated by buyers purchasing directly from sellers' homes and sellers reporting to have quickly sold out. In the past year, Timor-Leste's economy has been affected by the COVID-19 pandemic and natural disasters causing its national Gross Domestic Product (GDP) to fall to -8.5% in 2020, but it recovered in 2021 to 1.5% (Ministry of Finance, 2022). Farmers were unable to sell their produce due to market closures and movement restrictions. The Government of Timor-Leste has implemented several programs to stimulate economic recovery, including the Food Basket program (*Cesta Básica*) whereby the government purchases produce from local farmers and re-distributes to all local populations during the pandemic (RDTL 2021). Therefore, mung bean was very quick to sell out. Nonetheless, how sustainable such a scheme is over the long term is questionable. Rather, the government should create better linkages with consumers and the private sector to reduce dependency on the state and food imports during future crises.

All but one respondent stated that they wanted to plant mung bean again in the future even without support from AI-Com and MAF. As highlighted above, mung bean fetches a good price in the market and can be a supplementary income source. Respondents' positive attitude towards this innovation is demonstrated through 20 respondents who have shared their experience and knowledge implementing this innovation with their peers. Eight respondents reported that farmers with whom they have disseminated information have started to trial this innovation, seven respondents stated that their peers have not trialed yet, while four respondents stated that their peers will try in the upcoming cropping season and one farmer could not trial because they had no mung bean seeds.

Herbicide application helps farmers reduce time and labour spent on weed control. Out of 23 respondents who applied herbicides, 12 reported no weed growth while 11 stated "yes" to weeding but it only took them 1 or 2 days per week to monitor weeds. All FGD participants (N=29) applied herbicides before planting and did not weed. Most farmers purchased herbicides (N=18), followed by 12 who received herbicides through MAF researchers and extensions officers. Some farmers received free herbicide for their first trial, but they purchased herbicide from the market for their second crop. Herbicide use also reduces farmers' need to hire a tractor (USD\$40-USD\$50/day) to plough their land to remove weeds. Farmers who could not afford to buy herbicide reported dense weed growth as a challenge to planting mung bean. Indeed, the lead MAF researcher in Betano stated that a major constraint for farmers on the

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south coast is the rapid growth of dense weeds, which means farmers cannot plant without first ploughing their fields with tractors to remove weeds (Betano Research Center, *pers comm.* 17 June 2021).

Men and women hold different roles in household agricultural production and taking a gender perspective can ensure pre-existing inequalities within households are not deepened, improve crop production and also the long-term adoption of innovations. Most respondents indicated that both heads of HH were jointly involved in deciding to implement the low labour mung bean system (77%). They responded similarly in terms of decision making on mung bean sale (65%) and the use of income derived (68%). These findings, together with the gendered labour roles (e.g., men were responsible for herbicide application while women took charge of carrying, drying and threshing mung bean), suggest men and women are inter-dependent in implementing the low labour mung bean system.

The gross margin analysis indicates that the gross income obtained from low labour mung bean system (no tillage) is higher (USD\$509/ha) than using traditional method or tillage (USD\$418/ha). Furthermore, the labour analysis indicated that the low labour mung bean innovation helps save working time for both men and women. Compared to the conventional method which requires ploughing for weed control before planting, using herbicide and planting with a dibble stick helps to reduce 13 working days for men and 18 working days for women per hectare of land. When using herbicide and broadcasting, it reduces 22 working days for men and 38 working days for women. Not only that, it also increases the dollar return on labour from USD\$4.00/day to USD\$8.00/day when planting using dibble stick and to USD\$15.00/day when broadcasting. Since our findings show that men took charge of herbicide application because the sprayer tanks were considered too heavy by women, providing alternative, physically less demanding technologies for herbicide application can lessen the work burden for men and empower women who face labour concerns.

Herbicide application helps farmers to reduce energy expended in the field and the cost for hire labour for weed control and most of the recommendations given by surveyed farmers was to continue to support them with herbicide. As highlighted above, no significant difference in production was recorded between herbicide users and non-users, nonetheless, herbicide application increases production per labour day. Considering herbicide application is an important aspect of this innovation to reduce labour expenditure for men and women, hence, in addition to considering alternative technologies to the sprayer tank which can lighten labour burdens, we recommend that training on appropriate use and safe handling of herbicide should continue (e.g., AI-Com and MAF regularly share information on appropriate herbicide application and safe handling during Field Days and before innovations are implemented).

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## VI. Appendices

### Appendix 1. Price of mung bean in Fatukahi village, recorded by MAF-Extension officer in-charge.

Table 16 List of farmers who sold mung bean in Fatukahi village, recorded by extension worker in-charge.

Label	Production (kg)	Price/kg	Total USD
R1	410	1.75	717.5
	135	1.5	202.5
R2	25	1.75	43.75
	25	1.5	37.5
R3	151	1.25	188.75
	114	1.75	199.5
	76	1.5	114
R4	70	1.25	87.5
	80	1.75	140
	40	1.5	60
R5	214	1.75	374.5
	46	1.5	69
R6	100	1.25	125
	40	1.75	70
R7	50	1.25	62.5
R8	54	1.75	94.5
R9	56	1.25	70
	121	1.75	211.75
	87	1.5	130.5
R10	56	1.25	70
	214	1.75	374.5
	100	1.5	150
R11	228	1.5	342
<b>Total</b>	<b>2492</b>		<b>3935.25</b>

## Appendix 2: Labour activities and gender roles based on data from women's FGD.

Table 17 Labour activities and gender roles based on the data obtained from women's FGD

Low labour mung bean production activity	Is this activity performed by men or women?		Total Labour (days/ha)		Total working days (ha)
	Women's answers	Comments	Men	Women	
<b>1) Land preparation</b>					
Fencing (This work is not done by all mung bean farmers)	Men's role	1) Too heavy for women 2) Women prepare food, fetch clean water	30		1 month
Spray standing crops and weeds with herbicides	Men's role	1) The spraying tank is too heavy for women 2)	1	0	2-3days
		Fetch clean water and cook	5	0	1-2 days
Water the rice-field before planting	Men's role	Because this work is done at night time	1	0	1 day
<b>2) Plant/Broadcast mung bean</b>					
			2	4	1 day for 0.5 ha
Using dibble stick	Men and Women's role	Helping each other. Women plant and men draw the rope	1	1	5 days for 1 ha
			2	4	2 days
			3	10	2 days for 1 ha
Broadcasting	Men's role	Women fetch clean water and cook	1	0	1 day
Using injector	Men's role	Women fetch clean water and cook	2	0	1 day
<b>3) Weeding</b>		No weeding as we have sprayed with herbicide			
<b>4) Harvest mung bean</b>					
			2	2	10 days
Picking pods	Men and women's role	Women cannot pick the pods alone. It requires much labour	1	1	one week
			2	2	3 weeks
			3	2	3 weeks
			1	1	3 weeks

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Drying	Men and women's role	Helping each other	1	1	2 days
Threshing	Men and women's role (N=6)	Because we help each other	2	2	1 day
Cleaning	women's role	Because men cannot winnow the mung bean with wide shallow basket	0	with group members or neighbours	2-4 days
<b>5) Selling mung bean (Marketing)</b>	Men and women's role	Only sell at home			

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## Appendix 3: Labour activities and gender roles based on the data obtained from men's FGD.

Table 18 Labour activities and gender roles based on the data obtained from men's FGD.

Low labour mung bean production activity	Whose role?		Total Labour (days/ha)		Working days
	Men's answers	Comments	Men	Women	
<b>1) Land preparation activity</b>					
Fencing (This work is not done by all mung bean farmers)	Men and boy's role	Women help in cooking	10-20	0	30
Spray stand crops and weeds with herbicides	Men's role (Only in Betano)	Women help in cooking	2	0	Depends on the size of land
Put water into the rice-field before planting	Men's role	Done a night before broadcast mung bean	1	0	1
<b>2) Grow mung bean</b>					
Grow mung bean by using dibble stick	Men and women's role	Women plant and men draw the rope	2 2	4 3	2-7 days 2-3 days
Grow mung bean by broadcasting	Men's role	Women help in cooking	1	0	One hour
Grow mung bean by using injector	Men's role	Women help in cooking	2	0	1 day
<b>3) Weeding</b>		No weeding because we have sprayed with herbicides			
<b>4) Harvest mung bean</b>					
Pick up the pods	Men and women's role	Helping each other	4	4	7-15 days
Drying	Men and women's role	1) Takes time depending on the sun 2) It is light. Therefore women can carry it in the sack	1	1	1-2days
Threshing	Men and women's role	Helping each other	2-3	2-3	2 weeks
Cleaning	Women's role	Men do other work	0	1-3	7 days
<b>5) Selling mung bean (Marketing)</b>	men and women's role	Women manage the money			
<b>6) Transporting</b>	Buyers buy at home			Selling at home	



Figure 7 Researchers with the mung bean plants in the rice field in Betano, during a field day held on September 21, 2021.



Figure 8 Researchers and women FGD participants in Betano Village, February 15 2022.



Figure 9 Male Focus group discussion participants with MAF Researcher Mr. Valerio in Fatukahi (Fatuberlihu) on February 18, 2022.



Figure 10 Field observations held in Alas, on February 16, 2022.