TOMAK Component 2 Midline Evaluation

Report | March 2021

TOMAK
To'os ba Moris Di'ak

Australian Aid

Abbreviations and acronyms

AEW	Agricultural extension worker
BDS	Business Development Services
BL	Baseline
Demplot	Demonstration plot
DHS	Timor-Leste Demographic and Health Survey (2016)
EOPO	End of program outcome
FAO	Food and Agriculture Organization of the United Nations
FFD	Farmer Field Day
FFS	Farmer Field School
FGS	Farmer Group Strengthening
GAP	Good agricultural practice
ha	Hectare
HH	Household
HHDM	Household decision-making
IADE	*Instituto de Apoio ao Desenvolvimento Empresarial* (Institute of Business Support and Development)
KEQ	Key evaluation question
kg	Kilogram
MB	Mung bean
MAF	Timor-Leste Ministry of Agriculture and Fisheries
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity for Women
MELF	Monitoring, Evaluation and Learning Framework
MELP	Monitoring, Evaluation and Learning Plan
MLc	Midline control group
MLt	Midline treatment group
MR	Men respondents
N	Number (total number of cases)
N/A	Not available or not applicable
NSA	Nutrition-sensitive agriculture
P	Peanut
PCA	Principal Component Analysis
PO	Program officers
PPI	Progress out of Poverty Index
RR	Red rice
S/O	Shallot/onion
m^2	Square meter
T	Tercile (T1: 1st tercile, T2: 2nd tercile, T3: 3rd tercile)
TOMAK	*To'os Ba Moris Di'ak* (Farming for Prosperity) Program
USD	United States Dollars
VC	Value chain
WEAI	Women's Empowerment in Agriculture Index
WI	Wealth Index
WG	Washington Group
WR	Women respondents
WRA	Women of reproductive age

Table of Contents

List of tables

List of figures


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Executive summary

The *To'os Ba Moris Di'ak* (Farming for Prosperity) Program (TOMAK) is a $25 million, five plus five-year agricultural livelihoods program funded by the Australian Government in Timor-Leste. TOMAK is implementing two interventions in parallel: Component 1 promotes nutrition-sensitive agriculture approaches and Component 2 promotes the development of commercial agriculture following a market systems development approach and focusing on four crops with high agribusiness potential: mung beans, shallot/onions, red rice and peanuts (referred to as the value chain crops or VC crops throughout the report). As the program nears the end of its first phase, a midline survey was implemented to assess results achieved during the program's first five years.

Methodology

The midline evaluation objectives included:

1. To estimate changes in production volumes and value;
2. To evaluate changes in farming practices;
3. To assess the frequency and type of support received by farmers;
4. To evaluate changes in women's economic empowerment; and
5. To evaluate impact of nutrition activities.

To achieve these objectives, 224 expansion farmers and 130 control farmers were interviewed in November-December 2020 (46% women). Expansion farmers are farmers who have attended Farmer Field School (FFS) training and Farmer Field Days (FFD) conducted by TOMAK, and later replicated what they learned during the FFS in their own farm. The data collected was compared to baseline data collected in 2017 (for mung beans and shallot/onions) and 2018 (for red rice and peanuts).

The most important limitations for this study are:

1. Missing data on area of VC crops cultivated for 202 respondents;
2. Reliability of production data (i.e. volumes produced and sold, areas and productivity);
3. Lack of representativeness of the mung bean/shallot/onion baseline (small sample size); and
4. Differences in methodology and tools used between the two baseline surveys and the midline survey.

Findings

1. Demographic profile of respondents

Respondents were interviewed in all three municipalities where TOMAK is working: 25% in Baucau, 62% in Bobonaro and 13% in Viqueque. Of the respondents, 89% were married and 9% were part of women-headed households (HHs).

A Wealth Index (WI) was computed using a Principal Component Analysis (PCA) applied to variables on house construction materials, asset ownership and house facilities. Households were then ranked into poverty terciles that were used during the analysis to compare different groups of respondents. Overarching observations were: (1) distribution of poor/medium/wealthier HHs was very balanced among treatment farmers, (2) red rice expansion farmers were often wealthier than others.

2. Agricultural profile of respondents

The most frequently grown crops were maize (96%), vegetables (84%), fruits (78%) and cassava (78%). Significantly more farmers reported growing mung beans, shallot/onions and peanuts at midline, in both the control and treatment group (about 20% more). However, fewer farmers grew rice in 2020 compared to 2018 (from 50% to 24%) as rice production was affected by drought in early 2020. Late and limited rainfall at the start of 2020 negatively impacted many farmers in Timor-Leste, including TOMAK-supported farmers. Rice farmers in particular establish seedlings in nurseries and must wait for sufficient rain to transplant the seedlings to their fields, which in many cases was not possible or delayed due to drought in 2020.

Among all the crops farmers produce, shallot/onions, mung beans and peanuts were among the top five crops that were the most frequently sold, thereby confirming their high commercial potential. The vast majority (95%) of shallot/onion expansion farmers sold shallot/onions in 2020, followed by 91% for peanut producers, 87% for mung bean producers and 75% for red rice producers.

The total land cultivated was 1.5ha among treatment farmers and 1.2ha among control farmers. The large majority of farmers reported owning the land where they live and work, but half of them did not have any official certificate of ownership or similar document for their land.

Overall, 91% of the expansion farmers said they could see a future in farming, which was similar to the result (90%) for control farmers. “Seeing a future in farming” was determined by a combination of two concepts: (1) believing farming provides sufficient income to support the family, and/or (2) wanting children to become farmers as well later. Shallot/onion producers were the most convinced: 94% vs. 83% for red rice producers for example.

In terms of livestock, the most commonly raised animals were chickens (92%), pigs (57%), cows (54%) and goats (43%). Chickens were either consumed or sold while pigs/cows/goats were mostly raised for selling.

3. Value chain crops production

Land cultivated: Treatment farmers have focussed on one of four value chain crops, growing on average 5,000m^2 of red rice, 3,200m^2 of peanuts, 3,000m^2 of mung beans and 123m^2 of shallot/onions, respectively. These areas were larger than those at baseline except for shallot/onion – mainly because at midline, enumerators counted the number of beds rather than the size of the plot. Yet, this increase was not only induced by TOMAK as control farmers also reported growing larger areas of mung beans and red rice.

Production costs: On average, treatment farmers spent per farm USD217 for red rice, USD82 for peanut, USD47 for mung bean and USD41 for shallots/onions. Production cost per hectare is the highest for shallots (3,883USD/ha) but most producers grow only 10 to 15 beds (about 120-180 m^2) which is sufficient to obtain a very competitive return on investment. Profit per hectare for shallots/onions is extremely high (25,490USD/ha), followed by 2,497USD/ha for peanuts, 1,363USD/ha for mung beans and 762USD/ha for red rice.

Production volumes, productivity and value: Collecting reliable production data from farmers is a challenge, especially since 33% of the respondents had not been to school and 25% left school before completing primary school. Thus, the following data should be read with caution.

Expansion farmers produced on average 265kg of mung beans, 272kg of shallot/onions, 950kg of red rice and 645kg of peanuts (volume per farm). This represents a total value of USD398, USD407, USD475 and USD794, respectively. For peanuts and red rice, volumes were significantly higher

than the volumes produced by control farmers. But for shallot/onion and mung bean, interpretation of differences with control and baseline data is delicate (small baseline sample and no significant difference with control group).

Productivity data is also questionable as the cropped areas are missing for more than 200 farmers. Available data were as follows: 1,178kg/ha for mung beans, 19,726kg/ha for shallot/onions, 2,463kg/ha for red rice and 2,262kg/ha for peanuts.

Agricultural practices: The midline survey included an extensive list of question on farmers' practices. For all VC crops together, expansion farmers were applying 56% of the recommended Good Agricultural Practices (GAPs) vs. 44% among control farmers. The most significant differences were for shallot/onions (71% vs. 51% among control group) and peanuts (45% vs. 30% among control group). Fewer GAPs were assessed at the baseline. Among these GAPs, on average 40% were applied at midline vs. 23% at baseline. For red rice, practices that were still insufficiently applied included transplanting at a younger age, terracing and speeding up harvest/threshing. For mung beans, fewer farmers practiced ploughing, terracing, using organic pesticide, intercropping and threshing with a thresher. Note that men expansion farmers applied significantly more GAPs than women: 58% vs. 53% among women.

Access to inputs: Regarding the source of inputs needed to apply GAPs, improved seeds were mostly accessed through development agencies/organisations and also distributed by the Ministry of Agriculture and Fisheries (MAF) for free on a limited scale. Little was sourced locally from shops or farmer groups. Pesticides, fertilisers, herbicides and fungicides were mostly sourced from local shops although some farmers did get fertilisers from local agricultural extension workers (AEWs). Farmers also expressed their perception on how reliably they can access inputs: 81% of expansion farmers felt confident about this vs. only 43% for control farmers. This could be due in part to the fact that a portion of the expansion farmers interviewed were still benefiting from subsidised seeds and drip irrigation from TOMAK (50% subsidies during the first year). Overall seed costs for mung bean, red rice and peanuts are only a small portion of total costs, only for onion/shallots seeds represented a major cost factor.

Division of labour between men and women: Mung bean was the crop that involved the most women (planting, fertilising, drying, etc.), followed by peanuts (planting, mulching, drying, shelling). The production of red rice and onion/shallots was mainly dominated by men (women were involved in planting, weeding, harvesting and drying).

Constraints during production of VC crops: Significantly fewer peanut and red rice producers reported having faced constraints at midline compared to baseline (about 20% less) and compared to the control group (about 10% less). Disease management and weather remain the most frequently stated problems. Women respondents in particular noted disease problems affecting mung bean and peanut crops.

Constraints during post-harvest production of VC crops: More than half of the expansion farmers did not report any post-harvest constraints (this was highest for shallot/onions, where 78% of expansion farmers experienced no post-harvest constraints). Proportions of post-harvest losses estimated by farmers were very similar to what they were at baseline and among control farmers: 4% for mung beans, 5.2% for shallot/onions, 4.6% for red rice and 5.2% for peanuts. For red rice, 17% of expansion farmers are still struggling with the drying of the harvest. Effective storage remains a constraint for some farmers, in particular red rice and mung bean farmers (17% and 14% respectively). Yet, storage practices had improved including the use of high quality airtight bags for red rice, peanuts and mung beans, longer drying for shallot/onion and peanuts, and bags put in drums or on pallets.

4. Sales of VC crops and access to market

Use of harvest: In 2020, expansion farmers sold on average 47% of their harvest for mung beans, 62% for shallots/onions, 24% for red rice and 45% for peanuts. These values were smaller than the proportions sold at baseline. This does not necessarily mean that volumes sold are also smaller but limited baseline data on volumes produced significantly limits further analysis. Note that shallot/onion and peanut expansion farmers sold higher proportions of their harvest compared to control farmers: 43% and 35% respectively. For peanuts, this could be related to higher volumes produced among expansion farmers (645kgs vs. 331kgs among control farmers).

Sale of VC crops: Volumes sold per farm were higher for TOMAK's expansion farmers across the VC crops compared to the control group (except for mung beans where difference was marginal) with average sales of 155kg for mung beans, 171kg for shallot/onions, 282kg for red rice and 316kg for peanuts. Based on reported sale prices, the average income generated per farm was calculated at 283USD for mung beans, 372USD for shallot/onions, 380USD for red rice and 763USD for peanuts.

The majority (57%) of treatment farmers said collectors are coming to buy their harvest at farm gate (vs. 39% among control farmers) and 79% of them said they are confident that they can access collectors – vs. 65% among control farmers. The difference with control farmers is particularly important for shallot/onion, peanut and red rice producers: about 50% of expansion farmers are selling to collectors at farm gate while about 60% of control farmers sell to consumers at the local/municipal market, which can be more time consuming.

5. Agricultural extension services and other support to farmers

Most expansion farmers received intensive and quality support from AEWs employed by MAF and located in each suku (village). The vast majority of expansion farmers (91%) were visited by AEWs at their farm, 82% knew how to contact their AEW, 83% believed AEWs provide good advice and 88% stated that AEWs let farmers share their experience during Farmer Field Schools (FFS). This differed greatly from what control farmers experienced: only 8% were visited at their farm by an AEW, 11% knew how to contact their AEW and 54% from the respondents that knew their AEW thought AEWs gave them good advice.

The most frequent support AEWs provided to expansion farmers was: advice on pest and disease control (81%), agricultural inputs (71%) and nutritional advice (71%). Common nutritional topics raised by AEWs were: the importance of planting various foods and reserving food to eat after harvest (about 90% of treatment farmers) as well as the benefits of eating eggs (65%).

Expansion farmers also received marketing support (especially for 85% of shallot/onions), agribusiness training (45%), and drip irrigation equipment (66% of shallot/onion producers).

Note that about 12% of expansion farmers declared having received support from NGOs as well (trainings and fertilisers). This could be the case as other NGOs also work in TOMAK's target area but many farmers may have in fact been referring to TOMAK itself.

6. Farmers' knowledge

Several areas of knowledge were assessed during the midline survey.

Business management: About 20% of all expansion farmers kept records on production costs and income, and about 30% among those who had participated in agribusiness training. This is an important improvement as less than 5% of control farmers practice basic bookkeeping. Surprisingly, about 60% of both expansion and control farmers already knew how to calculate profit.

Agricultural knowledge: Technical knowledge significantly increased among TOMAK beneficiaries. Among the eight agricultural questions asked to assess respondents' knowledge, expansion farmers more often selected the correct answer than control farmers for six questions. Three of these answers were statistically significant between treatment and control: (1) proper peanut storage practices (78% vs. 51% of control farmers); (2) benefits of mulching (66% vs. 39%); (3) responsible use of pesticides (20% vs. 12%).

Nutrition knowledge: Expansion farmers' knowledge clearly increased in this area as well. For each of the five nutrition questions, significantly more expansion farmers responded correctly compared to control farmers. These questions related to the three food groups and their respective importance.

7. Decision-making

Decision-making over VC crop production: Women less frequently decide which VC crop to grow (50% women vs. 85% of men). Also, women expansion farmers are less involved in selling the harvest and managing the income generated from this sale compared to women control farmers: (1) 77% women sell the harvest vs. 88% among the control group; and (2) 92% women manage the income vs. 98% among the control group. Comparison with the baseline data is risky as most baseline questions did not specifically refer to the VC crops.

Decision-making over HH resources: Women of reproductive age (WRA) from the expansion farmer group more frequently reported equitable decision-making authority than WRA from the control group: (1) 58% women (vs. 46% control) were involved in decisions on which food crops to grow; (2) 69% women (vs. 59% control) were involved in decisions on which cash crops to grow; and (3) 62% women (vs. 54% control) were involved in decisions on which animals to raise. However, those differences were minor (no statistical correlation).

8. Dietary diversity

The Minimum Dietary Diversity (MDD) tool was used to collect information on what foods had been consumed during the last 24 hours prior to the interview.

Little change in beneficiaries' dietary diversity was observed: 36% of expansion farmers had consumed foods from at least five food groups vs. 32% of control farmers (not statistically significant). This difference is stronger when looking at women only: 43% of women expansion farmers reached the MDD vs. 33% of women control farmers (not statistically significant).

Discussion

The main areas of work of TOMAK Component 2 are discussed here in light of the midline survey findings.

1. **Access to inputs:** At midline, expansion farmers were overall very confident in their ability to source quality inputs. Yet, most currently rely on TOMAK and NGOs for drip irrigation as well as the government for quality seeds. Local initiatives to multiply improved seed varieties exist but remain insufficient.

2. **Production:** As a result of the FFSs for expansion farmers facilitated by AEWs together with TOMAK program officers (POs), agricultural and nutrition knowledge have significantly improved. Unfortunately, measuring the actual impact on production (cost, volume and productivity) is a challenge and comparisons with control farmers do not always reflect an improvement. A better

indicator of the program's impact on crop production is from farmers' agricultural practices which have significantly changed to enable higher productivity with a better use of natural resources (especially for shallot/onion and peanut). Note that one other factor could have also influenced the production results, though that could not be assessed in this study: the length of time the farmer has been involved in the program.

3. **Access to market:** TOMAK has been very successful in linking expansion farmers to collectors, which could have been a challenge, especially for red rice and shallot/onions which have to compete with imports from Indonesia and China. Limited production volumes do not attract collectors; in order to attract large scale collectors, volumes need to increase. Note another factor could have influenced the access to market, though this could not be assessed during this study: the closure of the local marketplaces in March/April 2020 due to the COVID-19 State of Emergency.

4. **Women's economic empowerment and social inclusion:** Men expansion farmers appear to have more decision-making power for the production of VC crops compared to the control group. This could be because farmers consider that commercial farming rather falls under men's responsibility but also because male AEWs themselves tend to work more closely with men than women. Another reason could be men's greater control over expensive assets like drip irrigation, or men's role to 'represent' the family when dealing with external actors like NGOs, AEWs, etc. TOMAK programming appears to be engaging people with light disabilities with relatively similar results experienced by these people.

5. **Nutrition:** Despite the fairly recent integration of nutrition activities within Component 2, survey data showed that knowledge on nutrition had already improved. Yet it seems like there is still room for improvement with AEWs as a source of nutrition information, as most farmers received nutrition information predominantly from TOMAK's POs and not from an AEW.

Recommendations

1. **Access to inputs:** Aspiring commercial farmers require high quality inputs in order to implement improved agricultural practices and increase their production. TOMAK's collaboration with MAF's extension service in conducting field level trainings is stimulating local demand for these inputs. TOMAK should increase its focus on local entrepreneurs (including farmer entrepreneurs) and encourage wholesale purchases of inputs, which can then be on-sold to other farmers seeking to expand their production. Attention should be paid to women farmers' access to inputs which could be facilitated through bulk purchases (women's farmer groups) and middle persons.

   Access to quality inputs can also be increased through local production. TOMAK should continue to promote the production of improved seed varieties by farmers and/or commercial seed producing groups, as well as local production of compost by farmers and local enterprises.

2. **Production:** Disease management was the most commonly stated production constraint. In coordination with MAF, it is recommended to conduct follow-up FFS training with meaningful participation of female farmers focusing on post-harvest (including seed storage) and disease management, especially for red rice, mung bean and peanut. Follow-up visits by AEWs are essential, since it takes considerable time before farmers are convinced to expand into larger areas for these VC crops.

   Furthermore, water shortage is a major bottleneck for agricultural production. This barrier could be addressed by improving farmer knowledge through TOMAK/AEW-led trainings on water harvesting, water storage and water conservation.

Currently, only one-third of expansion farmers use organic fertilisers and pesticides. In coordination with AEWs, TOMAK should continue to promote the use of organic fertilisers and pesticides to increase production. In addition, TOMAK should facilitate increased access for farmers to agricultural equipment that can improve productivity and lower women's labour burden.

In order to better measure the impact of the TOMAK program on production, specific attention should be paid to implement a consistent monitoring system for measuring the area size of the harvested crop as well as the weight of the produced crop. Farmers are in a better position to track their own production through good record keeping. TOMAK should continue agribusiness trainings, encouraging the involvement of literate family members, thereby promoting farming as a family business.

3. **Access to market:** Where access to market is still a major constraint, TOMAK should continue to identify local entrepreneurs (including farmer entrepreneurs) willing to become collectors and support them in this initiative. Furthermore, TOMAK should facilitate meetings between existing collectors and farmers (especially women or isolated/poorer farmers) to help develop trust and confidence among them. In coordination with MAF, TOMAK should create production nodes in order to attract buyers and larger collectors.

4. **Women's economic empowerment and social inclusion:** Survey data showed that household decision-making (HHDM) is improving regarding decisions about HH resources but is still limited regarding decisions over VC crop production. Continuous and integrated gender awareness and inclusion strategies mainstreamed throughout programming for all stakeholders is an important approach to improving women's economic empowerment. In particular, TOMAK should continue to develop AEWs' capacity to work with women farmers through ongoing inclusion training.

   TOMAK should continue to target motivated women as entrepreneurial farmers by encouraging women's participation in agribusiness training, ensuring that training materials are tailored to specifically support women's involvement.

   Furthermore, TOMAK should specifically target women by continuing to obtain labour saving equipment that is beneficial in directly reducing the workload for female farmers (e.g. peanut shellers and threshers for mung bean).

   TOMAK should consider approaches to better include people with disabilities, particularly those with more significant disabilities, across TOMAK programming. This should include the strengthening of knowledge and skills of program staff and MAF extension staff to promote and enable inclusion of farmers with disabilities.

5. **Nutrition:** MAF AEWs are considered to be a good link with farmers in terms of sharing family nutrition best practices. Continuing to work with AEWs to utilise a nutrition-sensitive agriculture (NSA) approach will further strengthen the link between agriculture and nutrition. With an early improvement of nutrition knowledge already observed amongst TOMAK farmers, efforts should continue to promote uptake of improved nutrition practices. Parallel program implementation with TOMAK Component 1 will most likely lead to such results.

   To this end, TOMAK should consider an integrated approach with TOMAK Component 1 that includes production and Savings & Loans with nutrition layered throughout the approach. This approach could also include messages on basic hygiene practices (e.g. increased focus on handwashing at the five critical handwashing times).

1. Introduction

The *To'os Ba Moris Di'ak* Program (TOMAK) is a $25 million, five plus five-year agricultural livelihoods program funded by the Australian Government in Timor-Leste, with Phase 1 implementation from 2016-2021. Its goal is to ensure rural households live more prosperous and sustainable lives. To achieve this, TOMAK is implementing two interventions in parallel: Component 1 promotes nutrition-sensitive agriculture approaches and Component 2 promotes the development of commercial agriculture following a market systems development approach. Four value chain crops were selected by TOMAK's Component 2 for their high agribusiness potential: mung beans, shallot/onions, red rice and peanuts. These value chains have been promoted and developed across TOMAK's three target municipalities (Baucau, Bobonaro and Viqueque).

As the program neared the end of its first phase, TOMAK was required to conduct a midline study. This midline aimed to gather data that can help the Australian Department of Foreign Affairs and Trade (DFAT) and TOMAK assess program performance, particularly in relation to the intermediate and end of program outcome (EOPO) levels of TOMAK's theory of change. The Component 2 EOPOs and their corresponding intermediate outcomes are as follows:

EOPO 3: Farmers improve productivity, production and post-harvest management

The intermediate outcomes under EOPO 3 are:

3.1: Farmers apply improved production practices
3.2: Farmers access required production inputs
3.3: Farmers apply improved business management practices
3.4: Service Level - Agricultural extension services provide extension support to farmers
3.5: Service Level - Input supply businesses provide farmers with a reliable supply of production inputs

EOPO 4: Farmers increase sales and incomes

The intermediate outcomes under EOPO 4 are:

4.1: Farmers produce to meet market demand/signals
4.2: Farmers perceive farming as a respectable vocation for the future
4.3: Women have equal access to the opportunities and benefits from commercial agriculture
4.4: Service Level - Business development services provide support for farmers
4.5: Service Level - Buyers connect farmers to markets and information on market requirements
4.6: Service Level - Women's organisations advocate for women farmers
4.7: Service Level - Government policy and programming supports women farmers and traders

To assess progress towards the EOPOs, the midline evaluation sought to answer the two Component 2 Key Evaluation Questions (KEQs):

KEQ 3: *To what extent has TOMAK contributed to target farmers having improved productivity, production and post-harvest management?*

KEQ 4: *To what extent has TOMAK contributed to target farmers increasing sales and income?*

A midline survey was developed to assess the performance of Component 2 approaches and activities. The survey tool was checked against the TOMAK Monitoring, Evaluation and Learning

Framework (MELF) and included suggestions and recommendations made in the TOMAK Program Evaluation Preliminary Report[1] – June 2020. Where possible, midline results have been compared to results from two baseline surveys that were conducted in 2017 (for mung beans and shallot/onion) and 2018 (for red rice and peanuts).

The methodology for the midline evaluation including the survey tool was developed by TOMAK in close collaboration with M&E House and reviewed by the DFAT activity manager for TOMAK. Data collection was conducted in November 2020. An external consultant performed the data analysis and write-up of results. TOMAK provided the consultant with a methodological guidance document that provided guidance on sampling, survey question design and analysis.

This report reflects the findings of the midline evaluation. The results of the study will feed into design considerations for TOMAK Phase 2. The midline report is structured in the following sections: Section 1 provides an overall introduction with background on TOMAK Component 2, the EOPOs and KEQs. Section 2 outlines the methodology applied and the limitations of the study. Section 3 provides the findings of the midline study, including a summary of results against impact and outcome indicators. Finally, Section 4 contains a discussion section as well as recommendations based on the key findings from the report.

1.1. Background of the Component 2 approach

Throughout Phase 1, TOMAK has partnered closely with the Ministry of Agriculture and Fisheries (MAF), in particular with the MAF extension service to promote improved farming practices for the four key VC crops across three municipalities. Over the past two years, more emphasis has been placed on expansion farmers and less on the establishment of demplots in order to reach a sufficient level of production. As much as possible, expansion farmer households have been selected in targeted areas close to each other in order to form clusters or “production nodes”.

How the demplot and expansion farmer program works:

TOMAK and MAF implement the program based on a sequenced two-step process:

1. Demplots: Farmer-led demonstrations are held to promote improved production practice. Farmer Field Schools (FFS) facilitated by MAF AEWs are conducted at critical stages of the production cycle, and allow 15-20 neighbouring farmers to observe and learn from improved practice vs. traditional practice. A larger Farmer Field Day (FFD) event is held at the time of harvest, involving a wider group of interested farmers, during which yield is measured through crop-cuts and profit calculated for both improved and traditional practice.
2. Expansion farmers: Farming households that have already hosted demplots or been involved in the FFSs are subsequently given the opportunity to expand production in the following season with a partial subsidy from TOMAK for any incremental cash inputs associated with adopting recommended improved practices. This is designed to kick-start wider adoption, and to more rapidly establish concentrated production nodes that can help underpin market development activities.

Developing agribusiness skills:

[1] This report was prepared by a group of consultants conducting an external mid-term review of the TOMAK program. The evaluation was cut short however due to travel limitations resulting from COVID-19 so the resulting report presented only emerging findings.

TOMAK has been supporting the Institute for Business Support and Development (IADE) to deliver agribusiness training to farmers since 2018. TOMAK supported IADE in the development of the targeted curriculum which includes two training modules. Module 1 focuses on the basic steps required for farmers to make the shift from subsistence to commercial farming, including basic concepts of how a market economy works. Module 2 focuses on developing basic skills for farmers to plan and manage their farming businesses better. Farming couples (both husbands and wives) are invited to attend the training, at times together but when that is not practical for them, separately. This is to encourage a common understanding of basic market concepts and also to emphasise the importance of bookkeeping, reinvestment and equitable decision-making for farming families.

As more demplot and expanding farmers have been onboarded to the program, IADE has continued to offer this training from 2018 - 2020.

Business Development Services (BDS) counselling sessions are offered to select farming households (husbands and wives together) who have completed Module 1 and 2 of the IADE agribusiness training and who would most benefit from ongoing counselling to support their progression to commercial farming. These sessions are facilitated by BDS-Smart, the first private sector provider of business development services in Timor-Leste.

Market engagement:

TOMAK conducted the following activities in order to further strengthen the link between farmers and output markets:

- Identified larger collectors and connected them directly to farmers.
- Identified output markets and connected them with collectors, farmers, and representatives of farmer groups.

TOMAK has started in the second half of 2020 progressing its agribusiness capacity building approach to focus on strengthening farmer groups. The most entrepreneurial farmers who have attended IADE agribusiness training and/or individual BDS counselling have been identified by TOMAK and in areas where a substantial number of these entrepreneurial farmers are clustered close to each other, farmer groups have been formed to sell produce collectively. These farmer groups consist of an average 10-20 farmers each, and the most active 10 groups have been selected to participate in Farmer Group Strengthening (FGS) training activities which commenced in December 2020.


79.30
UNITPRICE
TOTALPRICE
TCS
Electronic Price Platform Scale

2. Methodology

2.1. Evaluation objectives

The objectives of the midline evaluation were:

- To estimate change in production volumes and values for red rice, peanut, mung bean and onion/shallots.
- To evaluate change in farming practices (including farm management, production, productivity and post-harvest management) being applied by farmers for red rice, peanut, mung bean and onion/shallots.
- To assess the frequency and type of agricultural support received by farmers for red rice, peanut, mung bean and onion/shallots.
- To evaluate changes in women's economic empowerment and household decision making in households.

A secondary objective was to evaluate the impact of the recent integration of nutrition activities into Component 2.

2.2. Research plan

The midline data was collected using a survey questionnaire administered to the program's expansion farmers as well as control group of farmers selected outside of TOMAK's intervention area. This questionnaire included several modules:

- General information on farmers, their households and their overall agricultural activities.
- Production of mung beans, shallot/onions, red rice and peanuts: area grown, volumes produced, sales, production costs, constraints, etc.
- Support farmers received from TOMAK, AEWs and other sources.
- An assessment of farmers' knowledge on agribusiness concepts, agriculture, nutrition and hygiene.
- Decision-making in regards to the production of the value-chain crops but also in general.
- Dietary diversity (food consumed by the respondent during the last 24 hours).

Eleven MELF indicators from TOMAK's Theory of Change were covered by these different modules. Questions mostly consisted of closed ended-questions. Farmers' perceptions on a number of statements were also collected using Likert-scale questions.

Whenever possible, baseline questions were reused, allowing direct comparison of results. Yet, a number of questions had to be asked differently in order to collect more precise data (area grown, volume produced, and production costs). Note that both baseline reports used literature data (mostly from the Food and Agriculture Organization of the United Nations (FAO)) to report on production results, instead of data collected from farmers, as FAO data proved to be more conservative.

2.3. Sample and data collection

The midline survey targeted TOMAK's expansion farmers (also described in this report as the treatment group) and control farmers located in all three municipalities where TOMAK is working: Baucau, Bobonaro and Viqueque. Details of locations surveyed are available in Annex I.

Expansion farmers are farmers who have either hosted FFS and FFD events on their own farm, or attended these events at a neighbour's farm and later replicated what they learned during the FFS in their own farm. Enumerators requested to interview all expansion farmer households, as long as they became expansion farmers before July 2020. In households where there were two individuals considered expansion farmers – husband and wife – only one was interviewed.

In parallel to this, enumerators interviewed a control group with the objective to reach at least 50% of the total number of expansion farmers sampled. The control group was selected from farms with comparable conditions to TOMAK farmers, but who had not been exposed to TOMAK activities or similar interventions. Control farmers were dispersed overall proportionately by location of the treatment group. Most of TOMAK beneficiaries are located in Bobonaro, thus 62% of the survey respondents were in Bobonaro, 25% in Baucau and 13% in Viqueque. Table 1 presents the number of farmers interviewed by value chain crop.

Table 1. Sample size for control and treatment group, by value chain crop

Crop	Baseline[2]	Midline	
		Control	Expansion
Mung beans	16	47	79
Shallot/onions	20	35	65
Red rice	60	9	24
Peanuts	60	39	56
All VCs	**156**	**130**	**224**

Note that it was intended for the treatment group to encompass an even mix of female and male farmers but slightly more men were finally interviewed: 58% men in the treatment group and 49% in the control group.

Data collection was conducted by a team of 12 external enumerators working regularly for TOMAK. Data was collected using electronic questionnaires displayed on tablets to avoid data entry errors and allow quick processing of the data.

The fieldwork lasted four weeks, from 6 November - 11 December 2020 with about one week spent in Baucau and Viqueque and two weeks in Bobonaro where most beneficiaries are located.

[2] For mung bean and shallot, the baseline survey initially included 3 categories of respondents: treatment/spill-over (not directly involved in program)/control. For the purpose of comparing with midline data, treatment and spill-over farmers were combined as they all appeared to live in TOMAK's target area and could all potentially become TOMAK's beneficiaries.

2.4. Data cleaning and analysis

Data cleaning

Thorough data cleaning was conducted in order to check for consistency, coherence and completeness of the data. Inconsistent and incoherent data were verified with the data collection team and program team. Data was amended accordingly whenever possible. Analysis of possible outliers, especially for areas cultivated and production costs was conducted and extreme outliers were excluded from the analysis.[3] Annex II provides the complete list of data cleaning actions which were taken by the consultant.

Note that similar data cleaning was conducted with the baseline data sets in order to ensure comparable results. Baseline data sets were then compiled into a single data set and variables computed in a similar way as the midline data in order to allow for statistical comparisons.

Assessing progress since the baseline and identifying impact from TOMAK

An initial plan to use the Difference in Difference analysis to measure the program impact was abandoned as very limited data on the control group at baseline was available.[4] Instead, the size of the midline control group was increased in order to allow more reliable comparisons between the midline treatment and control groups.

For most results, the analysis was conducted in two steps:

1. The midline treatment group was compared to the baseline in order to see if the results had improved since the start of the program.
2. If that was the case, then comparison between the midline treatment and control group was used to evaluate how much of this change could be attributed to TOMAK's intervention. This second step was based on the assumption that the control group had similar characteristics with the treatment group at baseline stage.

Steps 1 and 2 were validated using statistical tests (Chi-square, Independent Sample T-test, One-Way Anova) for which results are presented in most tables under the columns "Statistically significant BL/MLt" for step 1 and "Statistically significant MLt/MLc" for step 2. Positive tests are marked with an * (or ** or *** if the strength of the correlation is stronger). Negative test results are marked with ^{NS} for not significant.

Note that whenever there are doubts about the quality or representativeness of the baseline data, it is mostly the comparison with the midline control group that is used to assess program impact.

Building a Wealth Index using a Principal Component Analysis (PCA)

In the baseline, data was collected in order to calculate the Poverty Probability Index. Since the questions and their score weightings are now very outdated, they are unsuitable for the midline and future poverty measurements. The midline included a short selection of questions, based on the most recent Demographic Health Surveys for Timor-Leste, about asset ownership and housing characteristics. From these questions, a new poverty index specific to the TOMAK sample was constructed.

[3] Box plot generated to identify outliers using the Interquartile Range Rule. Extreme outliers have a value above Q3 + 3*IQR.
[4] Control group at baseline consisted of 5 mung bean producers and 12 shallot producers. These were finally excluded from the analysis.

Firstly, 45 variables related to the household's economic situation were selected:

- All 10 variables related to ownership of animals;
- Land size;
- House ownership and amenities (number of rooms, construction materials, sanitation facilities and cooking fuel); and
- 25 variables related to the HH's assets.

All these variables were then transformed into binary variables that take only 0 and 1 to represent the categorical effect (0=unimproved situation / 1=improved situation). See Annex III for details on how variables were coded.

A first PCA was conducted with all 45 variables. Out of these 44 variables, 29 were then excluded as they did not have strong correlations with any other variables. An iterative process was then undertaken: several rounds of PCAs including or excluding certain variables based on factor coefficient scores were performed in order to obtain a satisfactory index. It was intended for the Wealth Index (WI) to include as many of the important variables possible while also representing the highest proportion of variance possible.

As a result of this process, the WI obtained is composed of 15 variables[5] and represents overall 23% of the data's variance. These variables are:

- Improved walls
- Improved roof
- Improved floor
- Improved cooking fuel
- Car/truck
- Motorcycle
- Electric iron
- Fan
- Fridge
- Computer
- Tape/CD player
- TV
- Electricity
- Tractor
- Bank account

Good Agricultural Practices Index

For each value chain crop, a list of GAPs was established and farmers were assessed on each of these GAPs. In order to summarise this in a meaningful and easily manipulated way, a "GAP Index" was computed by calculating the proportion of all GAPs that were applied by the farmer. The baseline surveys though, included a shorter list of GAPs. These are presented in Table 2 (in italics are those that were also included in the baseline).

[5] Final PCA conducted by forcing the 15 variables into 1 factor.

Table 2. List of Good Agricultural Practices used in the GAP Index, by VC

Mung bean GAPs: total 20 at midline and 7 at baseline	
• *Do not use fire to clear land* • Terracing • Hedgerows • Ploughing • *Ploughing organic matter into the soil* • Transplant (vs. broadcast) • Improved mung bean seeds • *Organic fertiliser* • *Inorganic fertiliser* • *Organic pesticide*	• *Inorganic pesticide* • Weeding • Harvest when pods are dry • Threshing with a thresher (vs. manually) • Drying • *Crop rotation* • Rotate after 1 or 2 seasons • Intercropping • Intercrop mung bean with maize and cassava • Plant legume trees
Shallot/onion GAPs: total 25 at midline and 11 at baseline	
• *Do not use fire to clear land* • Terracing • Hedgerows • Ploughing • *Ploughing organic matter into the soil* • *Organic fertiliser* • *Inorganic fertiliser* • *Organic pesticide* • *Inorganic pesticide* • Weeding • Drying • *Crop rotation* • Rotate after 1 or 2 seasons	• Plant legume trees • Level the soil • *Raised beds* • *Seed nursery* • Nursery on bamboo stilts • Plant onion seeds (vs. bulbs) • Use mini-bulbs from previous harvest • Improved onion seeds • *Drip irrigation* • Fertigation • *Mulching* • Harvest when leaves are yellow
Red rice GAPs: total 22 at midline and 8 at baseline	
• *Do not use fire to clear land* • Terracing • Hedgerows • Ploughing • *Ploughing organic matter into the soil* • *Organic fertiliser* • *Inorganic fertiliser* • *Organic pesticide* • *Inorganic pesticide* • Weeding • Drying	• *Crop rotation* • Rotate after 1 or 2 seasons • Plant legume trees • Transplant (vs. broadcast) • Threshing with a thresher (vs. manually) • Level the soil • *Seed nursery* • Transplant rice seedlings at 8-12 days • Improved rice seeds • Harvest with a mower (vs. manually) • Harvest rice in 1-2 days max
Peanut GAPs: *total 19 at midline and 8 at baseline*	
• *Do not use fire to clear land* • Terracing • Hedgerows • Ploughing • *Ploughing organic matter into the soil* • *Organic fertiliser* • *Inorganic fertiliser* • *Organic pesticide* • *Inorganic pesticide* • Weeding	• Drying • *Crop rotation* • Rotate after 1 or 2 seasons • Plant legume trees • *Mulching* • Harvest when leaves are yellow • Improved peanut seeds • Store bags in drums or on pallets • Shelling just before selling

Determining the proportion of women reporting equitable decision-making authority over HH resources and finances

Three questions were used to determine the proportion of women reporting equitable decision-making authority over HH resources and finances (indicator 45):

- How much input did you have deciding which crops should be grown for food?
- How much input did you have deciding which crops should be grown for sale?
- How much input did you have in making decisions about which animals should be raised?

Possible answers were: "1. No input, or input in few decisions", "2. Input into some decisions", "3. Input into most or all decisions", and "4. No decision made".

For this indicator, answer 1 was coded "1" and answers 2 and 3 were coded "0". Answer 4 was excluded as it was not relevant for this indicator. If respondents said they did not participate in the activity (i.e. replied "no" to questions "Did you yourself participate in food crop/ cash crop/ livestock raising in the past 12 months?"), they were coded "0" for indicator 45 as it was assumed that respondents do not have decision-making power for activities in which they are not involved.
Indicator 45 was calculated only among WRA, i.e. women between 15 and 49 years old.

2.5. Limitations

Missing data on area of VC crops cultivated for 202 midline respondents

Overall, 193 respondents (94 control farmers and 99 treatment farmers) did not know how much area of the VC crop they cultivated and a further nine provided abnormal measurements. This is a common issue among farmers in Timor-Leste and can only be overcome by visiting and measuring plots directly.

The area of cultivated VC crops is crucial information as it is needed to assess if the volumes produced and the production costs are on track with program expectations. The absence of such information for 57% of the midline sample is an important limiting factor for this midline study.

Reliability of the production data

Concern was also raised on the quality of the data related to production in both baseline and midline: areas cultivated, production costs, volumes produced and volumes sold. The midline data is likely to be more reliable than the baseline data as enumerators have been working closely with TOMAK for several years already. However, collecting reliable data from farmers remains a challenge in Timor-Leste, mainly because of farmers' very limited education level.

Most farmers do not keep records on their expenses or the volumes produced. The units used for measuring production volumes can differ from one farmer to another. For example, no volume data could be calculated for 24 midline shallot/onion producers as farmers simply left harvested shallot/ onions on the ground or on a table and were not able to estimate how many kilograms or sacks this represented. Also, similar units (a sack of red rice or a drum of peanuts for example) can have different weights depending on (1) the size of the sack or drum itself, (2) how filled they are, (3) how dry the harvest is, and (4) whether it contains shelled or unshelled peanuts/mung beans, milled rice or paddy, etc.

The following actions were taken to mitigate these difficulties:

- For volumes produced: average conversion rates (from farmer's measurement units to kilograms) were used based on TOMAK's field experience (see Annex IV). Abnormal data were excluded.
- For production costs: a review of abnormal expense amounts was conducted by the program team and for ploughing costs, the use of the standard rental cost for hand tractors was used in place of the cost farmers reported.
- For areas cultivated: abnormally high areas were excluded.
- For productivity, minimum and maximum thresholds were used to exclude abnormal data.

Limited sample size for mung beans and shallot/onions at baseline

The number of shallot/onion and mung bean farmers interviewed at the baseline was very limited (16 mung bean producers and 20 shallot/onion producers). The baseline report recognises this and considers this baseline study as a micro-baseline which "*is not representative and from which findings cannot be generalised across the TOMAK focus regions*".

For the purpose of this midline study, it was important to perform as many reasonable comparisons as possible, systematically reporting when limitations related to sample size or methodology could impact on the interpretation of these comparisons.

Mindful of this, it should be noted that all comparisons with mung bean and shallot/onion baseline data are to be interpreted carefully. And comparisons with the midline control group are most likely more reliable for these two crops.

Lack of uniformity between the two baseline surveys

In mid-2017, a baseline survey was conducted for mung bean and shallot/onion. Then in early 2018, another baseline survey was conducted for red rice and peanuts. A lot of differences exist between the methodologies and tools used for these two baselines. This directly impacts on how results could be combined and thus, how comparisons with midline results were made. Some of the major differences are:

- The mung bean and shallot/onion baseline interviewed men and women of the same HHs separately (using slightly different modules, which were simpler for women). Unfortunately, it was not possible to pair information coming from men and women of the same HHs (survey forms did not include any code to be able to do this). Thus, only very limited use of the data collected from women could be made.
- The mung bean and shallot/onion baseline included a control group while the red rice and peanut baseline did not.
- For a number of key questions (constraints, use of harvests, decision-making questions, etc.), the mung bean and shallot/onion questionnaire did not specifically refer to the VC crops. Such questions were asked for all the crops grown by the HH.
- The red rice and peanut baseline did not include questions on volumes produced.

Lack of uniformity between the midline and baseline questionnaires

Whenever possible, the midline questionnaire used the same questions as those used in the baseline. But for several questions/modules, improvements were needed in order to collect higher quality data. The downside of this is that baseline and midline results are not always strictly

comparable. Some example of these differences are: (1) the area cultivated was collected using ranges at baseline (i.e. from 0.01 to 0.149 ha, from 0.150 to 0.299 ha, etc.) and using exact areas at midline, (2) questions on GAPs were more extensive in the midline thus two versions of the GAP Index were needed to be able to compare the different groups studied, (3) questions on assets ownership were more extensive in the midline, allowing the computation of a more comprehensive WI while measurement of poverty at baseline is done using the Progress out of Poverty Index (PPI) which is now very outdated (2012).

Note that the report systematically reminds the reader when such differences can impact on the comparisons made.

Use of literature data in place of collected data in the baseline reports

For production results, the baseline reports did not use information collected from farmers but rather from FAO estimations which were considered to be more conservative/realistic than the collected data. However, the methodology used to triangulate the collected data with secondary sources (such as FAO) was not explained.

This approach prohibits further statistical analysis between groups of respondents, including with midline data. For this midline study, it was therefore decided to return to the data collected from baseline respondents in order to compare these to midline respondents. Prior to this, in depth cleaning of the baseline data was conducted to ensure as much coherence and consistency as possible in the baseline information.

In parallel to this, and to align with the baseline methodology, FAO data on productivity is also presented in this report in order to compare these with the midline productivity data.

3. Findings

This section outlines the findings of the midline survey. The key results under each KEQ have been included in Table 3, together with the relevant indicators that were measured. Across these key indicators, the majority of targets have been achieved.

Table 3: Summary of TOMAK indicators including Monitoring, Evaluation and Learning Plan (MELP) targets and final year assessment

#	Indicator		Baseline result		Midline result		Target (Y5)	
			N	Value	N	Value	MELP	Actual
End Of Program Outcome 3: To what extent has TOMAK contributed to target farmers having improved productivity, production and post-harvest management?								
33	Proportion of farmers trained adopting improved business management practices	- Develop a business plan - Keep records on prod. costs - Keep records on income - Know how to calculated profit	N/A N/A N/A N/A		223 223 223 223	85% 29% 39% 63%	30% of farmers trained	Reached Almost reached Reached Reached
35	Percentage increase in yield by crop	- Mung beans - Shallot/onions - Red rice - Peanuts	15 13 N/A N/A	1,451 kg/ha 3,235 kg/ha N/A N/A	26 34 13 23	1,178 kg/ha 19,726 kg/ha 2,463 kg/ha 2,262 kg/ha	20%	Not reached Reached RR: N/A P: N/A
End Of Program Outcome 4: To what extent has TOMAK contributed to target farmers increasing sales and income?								
42	Proportion of TOMAK farmers confident that they are able to reliably access collectors	- Mung beans - Shallot/onions - Red rice - Peanuts	N/A N/A N/A N/A	N/A N/A N/A N/A	79 64 24 56	81% 78% 71% 82%	N/A	
44	Instances of farmers who see a future in farming		N/A	N/A	353	91%	N/A	
45	Proportion of women reporting equitable decision-making authority over HH resources such as:	- which food crop to grow - which cash crop to grow - which animal to raise	N/A N/A N/A	N/A N/A N/A	76 78 78	58% 69% 62%	50% of women	Reached Reached Reached

#	Indicator		Baseline result		Midline result		Target (Y5)	
			N	Value	N	Value	MELP	Actual
48	Proportion of HHs that are selling produce (by crop)	- Mung beans - Shallot/onions - Red rice - Peanuts	16 20 60 60	100% 100% 100% 100%	79 64 24 56	87% 95% 75% 91%	60% of farmers, by crop	Reached Reached Reached Reached
49	Number of TOMAK supported HHs that report increased income from agricultural sales (i.e. above $100)	- Mung beans - Shallot/onions - Red rice - Peanuts		14 14 N/A N/A		60 41 22 43	N/A	
50	Volume and value of produce sold by HHs (by crop)	**(a) Volume:**						
		- Mung beans - Shallot/onions - Red rice - Peanuts	16 20 N/A N/A	200kg 242kg N/A N/A	76 48 22 54	265kg 272kg 950kg 645kg	25% increase	Reached Not reached N/A N/A
		(b) Value:						
		- Mung beans - Shallot/onions - Red rice - Peanuts	16 20 N/A N/A	$300 $363 N/A N/A	76 48 22 54	$398 $407 $475 $794	25% increase	Reached Not reached N/A N/A

Data for indicator 34 "Proportion of farmers trained applying improved practices" are presented below (Table 4). For this indicator, the MELP target is "40% of farmers trained". Values that reach this target are highlighted in bold (which was the case for 56 out of 82 values, i.e. 68% of all values).

Table 4. Summary table for indicator 34 on Good Agricultural Practices

Improved practices	Mung beans		Shallot/onions		Red rice		Peanuts	
	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Land preparation								
Do not use fire to clear land	**75%**	**49%**	**65%**	**59%**	**98%**	**79%**	**40%**	34%
Terracing	N/A	20%	N/A	**66%**	N/A	38%	N/A	16%
Hedgerows	N/A	**72%**	N/A	**74%**	N/A	29%	N/A	**77%**
Plough	N/A	39%	N/A	**100%**	N/A	**96%**	N/A	30%
Plough organic matter into the soil	6%	**93%**	5%	**89%**	0%	**96%**	33%	**93%**
Soil levelling			N/A	**98%**	N/A	**91%**		
Raised beds			25%	**100%**				
Planting practices								
Transplant (vs. broadcast)	N/A	**100%**			N/A	**88%**		
Seed nursery			30%	**94%**	**93%**	**100%**		
Nursery on bamboo stilts			N/A	**90%**				
Transplant rice seedlings at					N/A	21%		
Plant onion seeds (vs. bulbs)			N/A	**85%**				
Use mini-bulbs from previous			N/A	**90%**				
Plant improved seeds	N/A	**94%**	N/A	**97%**	N/A	**92%**	N/A	**88%**
Irrigation practices								
Drip irrigation			5%	**67%**				
Fertigation			N/A	**88%**				
Fertilisation, pest/disease/weed management practices								
Mulching			20%	36%			0%	32%
Organic fertiliser	19%	9%	**45%**	**94%**	0%	38%	8%	16%
Inorganic fertiliser	19%	6%	**40%**	9%	2%	25%	2%	4%
Organic pesticide	19%	8%	15%	20%	15%	21%	3%	7%
Inorganic pesticide	6%	38%	20%	20%	28%	**67%**	5%	14%
Weeding	N/A	**84%**	N/A	**98%**	N/A	**100%**	N/A	**96%**

Improved practices	Mung beans		Shallot/onions		Red rice		Peanuts	
	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Harvest and post-harvest practices								
Harvest with a mower (vs. manually)					N/A	4%		
Harvest rice in 1-2 days max					N/A	**42%**		
Harvest when leaves are yellow			N/A	**100%**			N/A	**100%**
Harvest when pods are dry	N/A	**100%**						
Threshing with a thresher (vs. manually)	N/A	6%			N/A	**96%**		
Drying								
Store bags in drums or on pallets							N/A	**57%**
Shelling just before selling							N/A	**70%**
Rotation and intercropping practices								
Rotation	19%	**46%**	5%	**80%**	7%	4%	22%	41%
Rotate after 1 or 2 seasons	N/A	**100%**	N/A	**100%**	N/A	**100%**	N/A	**100%**
Intercropping	N/A	19%						
Intercrop mung bean with maize and cassava	N/A	**80%**						
Plant legume trees	N/A	**81%**	N/A	**74%**	N/A	25%	N/A	**77%**

3.1. Demographic profile of respondents

3.1.1. Respondents' general profile

In the midline survey, a much higher proportion of respondents were interviewed in Bobonaro, which reflects the higher proportion of program beneficiaries in this municipality (65% of the treatment respondents are in Bobonaro vs. 23% in Baucau and 12% in Viqueque). This balance was fairly different from the baseline which surveyed more respondents in Baucau, mainly because more red rice and peanut producers were interviewed.

Table 5. Respondents' profile

	Baseline N=156	Midline N=354
Municipality		
Baucau	46%	25%
Bobonaro	28%	62%
Viqueque	27%	13%
Gender of respondent		
Female	39%	46%
Male	61%	54%
Respondent is a woman of reproductive age (15-49 years old)	26%	38%
Status		
Single	N/A	5%
Married	N/A	89%
Widow	N/A	5%
Divorced	N/A	2%
Education level of respondent		
Not been to school	N/A	33%
Dropped out before completing primary	N/A	25%
Completed high school	N/A	38%
University	N/A	4%
Disability[6]		
No disability	N/A	73%
Light disability	N/A	27%
Significant disability	N/A	0.5% (1 case)
Respondent is part of a woman headed HH	N/A	9%
Average number of HH members	N/A	6.2
Number of HH members		
1-2	3%	4%
3-5	26%	35%
6-8	49%	46%
9 or more	21%	15%

[6] Persons with significant disability answered "a lot of difficulty" or "not able to perform" to at least one of the six Washington Group questions. Persons with light disability answered "some difficulty" to at least one of the six Washington Group questions.

Slightly more men were interviewed at midline, however a reasonable proportion of women were interviewed allowing for meaningful comparisons between men and women.

The proportion of women-headed HHs at midline (9%) is lower than the national average (18%). Also, the proportion of women-headed HHs among treatment farmers is lower than among control farmers: 6% vs. 13% among control farmers. Exploring and understanding why these differences have occurred would be interesting for TOMAK and enable the program to target HHs which may be more vulnerable in the future.

Only one person with significant disability was interviewed ("a lot of difficulty seeing"). This person was a male shallot/onion expansion farmer from Baucau. People with light disability mostly had some difficulty seeing (20% of midline respondents) or walking/climbing steps (12%). The proportion of respondents with light disability was the same among control and treatment farmers which indicates that TOMAK is reaching a representative sample of the population.

Note that the midline report indicates whenever significant differences were observed between people with no disability and people with light disability.

Midline respondents were also asked if they were part of a group (Table 6), which was the case for 99% of the treatment farmers (mostly referring to TOMAK's activities which involve FFSs that are conducted for groups of farmers). Control farmers who were part of farmer groups most likely referred to non-TOMAK groups.

Table 6. Involvement in groups

Group types	Control N=130	Treatment N=224
Farmer group	34%	98%
S&L group	2%	7%
Nutrition group	2%	5%
None	65%	1%

Lastly, a question was asked to respondents regarding their preference between being part of a group or not (this question was mainly asked for TOMAK's programming purposes). Results are presented here.

Table 7. Farmers' preference as to being a member of a farmer group or not

	Control N=130	Treatment N=224
Prefers to be in a group	69%	43%
Neutral	4%	12%
Prefers not to be in a group	27%	45%

Among expansion farmers, opinion was divided as to whether it is better to work in a group or not. Rice and peanut expansion farmers were those more frequently preferring not to be in a group (54% and 48% respectively), while mung bean expansion farmers more frequently stated that they prefer to work in a group (48%). This was very different from control farmers who would mostly prefer to be part of a farmer group.

3.1.2. Household assets

Note that in the baseline, the only information that was collected regarding the HHs assets were those required for calculation of the PPI. This will be presented in the following section on WI.

Table 8. Midline households' assets and national data

	Control N=130	Treatment N=224	Stat. significant	National (2016 DHS)
House owner	99%	98%	NS	
Average number of sleeping rooms	3.7	3.3	*	58% have 3+
Improved source of drinking water	75%	73%	NS	79%
Improved sanitation	88%	86%	NS	50%
Improved source of cooking fuel	5%	4%	NS	9%
Improved floor material	63%	46%	*	46%
Improved roof material	92%	80%	*	
Improved wall material	18%	16%	NS	
Access to hand washing station	99%	100%	NS	90%
Electricity	87%	83%	NS	73%
Solar panel	15%	20%	NS	
Radio	29%	22%	NS	25%
Television	47%	43%	NS	40%
Tape/cd player	25%	20%	NS	
Mobile telephone	91%	87%	NS	84%
Telephone (non-mobile, fixed line)	6%	9%	NS	10%
Computer	7%	7%	NS	11%
Refrigerator	1%	18%	NS	20%
Fan	9%	12%	NS	
Chair	97%	99%	NS	
Sofa	6%	2%	NS	
Cupboard	89%	89%	NS	
Bed	98%	99%	NS	
Sewing machine	2%	5%	NS	
Electric iron	12%	19%	NS	
Watch	20%	20%	NS	
Bicycle	22%	21%	NS	15%
Motorcycle or scooter	38%	50%	**	21%
Animal-drawn cart	2%	1%	NS	1%
Car or truck	2%	4%	NS	5%
Tractor or hand tractor	12%	16%	NS	
Thresher machine	8%	9%	NS	
Boat with a motor	0%	1%	NS	
Bank account	18%	17%	NS	

Overall characteristics of treatment and control farmers were similar besides for housing materials (better quality floors and roofs among control farmers) and motorbikes (more frequent among treatment farmers).

National data from the 2016 Demographic and Health Survey (DHS) is also included as reference and shows significantly better access to sanitation facilities, electricity and motorbikes among the midline (treatment and control) participants. This suggests that midline participants are slightly wealthier than the national averages.

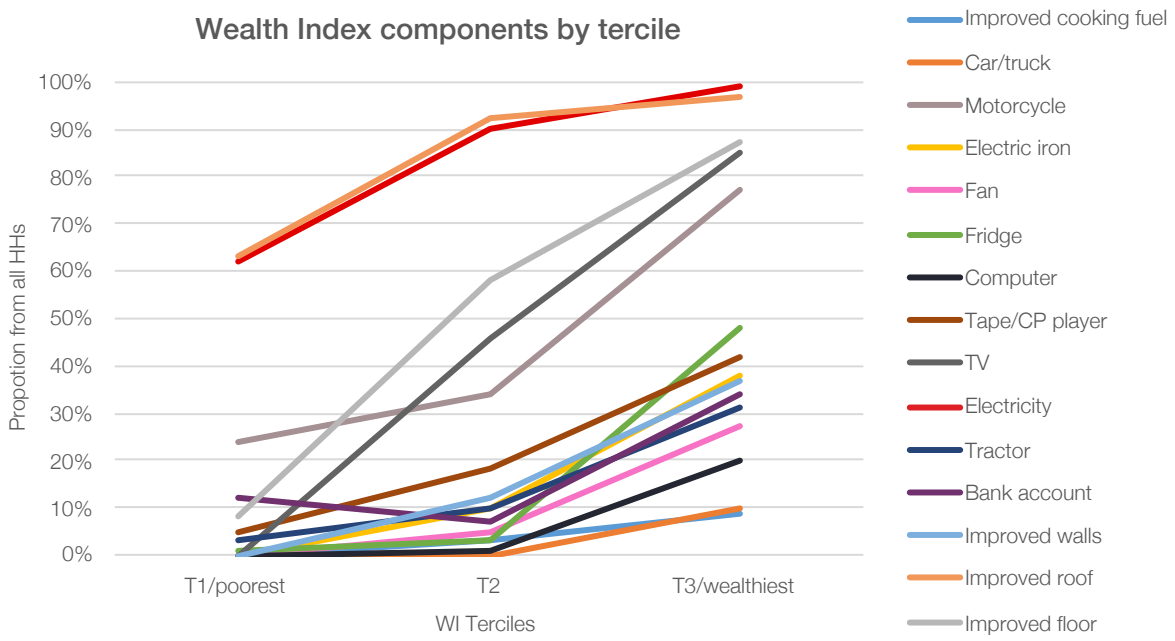
3.1.3. Wealth Index

In the baseline survey, information was collected in order to calculate the PPI. This was not repeated in the midline survey as the questions and score weights used in Timor-Leste's PPI scorecard are now very outdated. Instead, the midline survey built a WI based on HH assets, including livestock using a Principal Component Analysis. TOMAK will be able to repeat this analysis in follow-up surveys to see how beneficiaries' situations evolve.

Midline Wealth Index

Respondents WI scores (a continuous variable) were then ranked into terciles in order to form three wealth categories that can be easily used for analysis with other data. Figure 1 shows how each of the 15 variables load on each of the WI terciles.

Figure 1. Proportion of HHs with improved facilities or owning assets by WI tercile



As shown in Figure 1, there is a positive correlation between the 15 variables and the WI terciles: HHs of the third tercile are more likely to own assets and improved facilities than HHs of the second and first tercile.

Table 9 presents the proportion of control and treatment farmers in each WI tercile. The distribution of poor, medium and wealthier HHs is very balanced among the treatment group. Control farmers were on average slightly wealthier but the difference with the treatment group was not statistically significant.

Table 9. Proportion of HHs by WI terciles, compared to control group

	Control	Treatment
	N=130	N=224
T1 (poorest)	25%	35%
T2	41%	32%
T3 (wealthiest)	34%	33%

Table 10 looks only at midline expansion farmers to see if there were any differences in wealth based on expansion farmers' value chain crop. A number of observations can be made:

- Red rice expansion farmers are slightly wealthier than others: 54% among the third tercile vs 30% on average for other VCs.
- There is a correlation between municipality and WI: Baucau expansion farmers are on average slightly wealthier than in Viqueque or Bobonaro (82% among the second and third tercile vs. 60% in Viqueque and Bobonaro).
- No statistical correlation was observed between wealth and disability: there are similar proportions of people with light disability and no disability among the wealthier and poorer HHs.

Table 10. Proportion of expansion farmers in each WI tercile by categories of farmers

	N	T1 (poorest)	T2	T3 (wealthiest)
By VC				
Mung beans	79	39%	32%	29%
Shallot/onions	65	31%	32%	37%
Red rice	24	25%	21%	54%
Peanuts	56	38%	38%	25%
By municipality				
Baucau	52	17%	40%	42%
Bobonaro	145	40%	32%	28%
Viqueque	27	41%	19%	41%
By gender of head of HH				
Men	210	36%	31%	33%
Women	14	21%	50%	29%
By disability				
No disability	163	39%	31%	30%
Light disability	60	25%	33%	42%
Significant disability	1		100%	

Progress out of Poverty Index

The PPI was also calculated in order to provide some comparison with baseline data and also to see if the PPI scores and the WI were related. If this were the case, it could suggest that the PPI is still an interesting tool to measure poverty in Timor-Leste.

Table 11. Average likelihood of HHs to live below International Poverty Lines at baseline and midline

	Baseline N=156	Midline		Stat. significant BL/MLt	Stat. significant MLt/MLc
		Control N=59	Treatment N=121		
$2.50/day Upper International Poverty Line 2005	81%	71%	74%	*	NS
$1.25/day Lower International Poverty Line 2005	32%	16%	19%	*	NS

As presented in Table 11, there were significantly fewer HHs living under the upper and lower international poverty lines: 74% and 19% vs. 81% and 32% respectively at baseline stage. Yet, it is unclear whether this change was a result of TOMAK's intervention as the control and treatment at midline stage have quite similar proportions of respondents in WI tercile 1 (poorest).

Table 12 shows the proportion of HHs likely to live under national poverty lines (as per PPI) in each of the WI terciles. There is a clear correlation between the PPI and the WI but very little difference between the first and second tercile. This suggests the WI is more accurate and precise than the PPI.

Table 12. Proportion of HHs living under International Poverty Lines per WI terciles

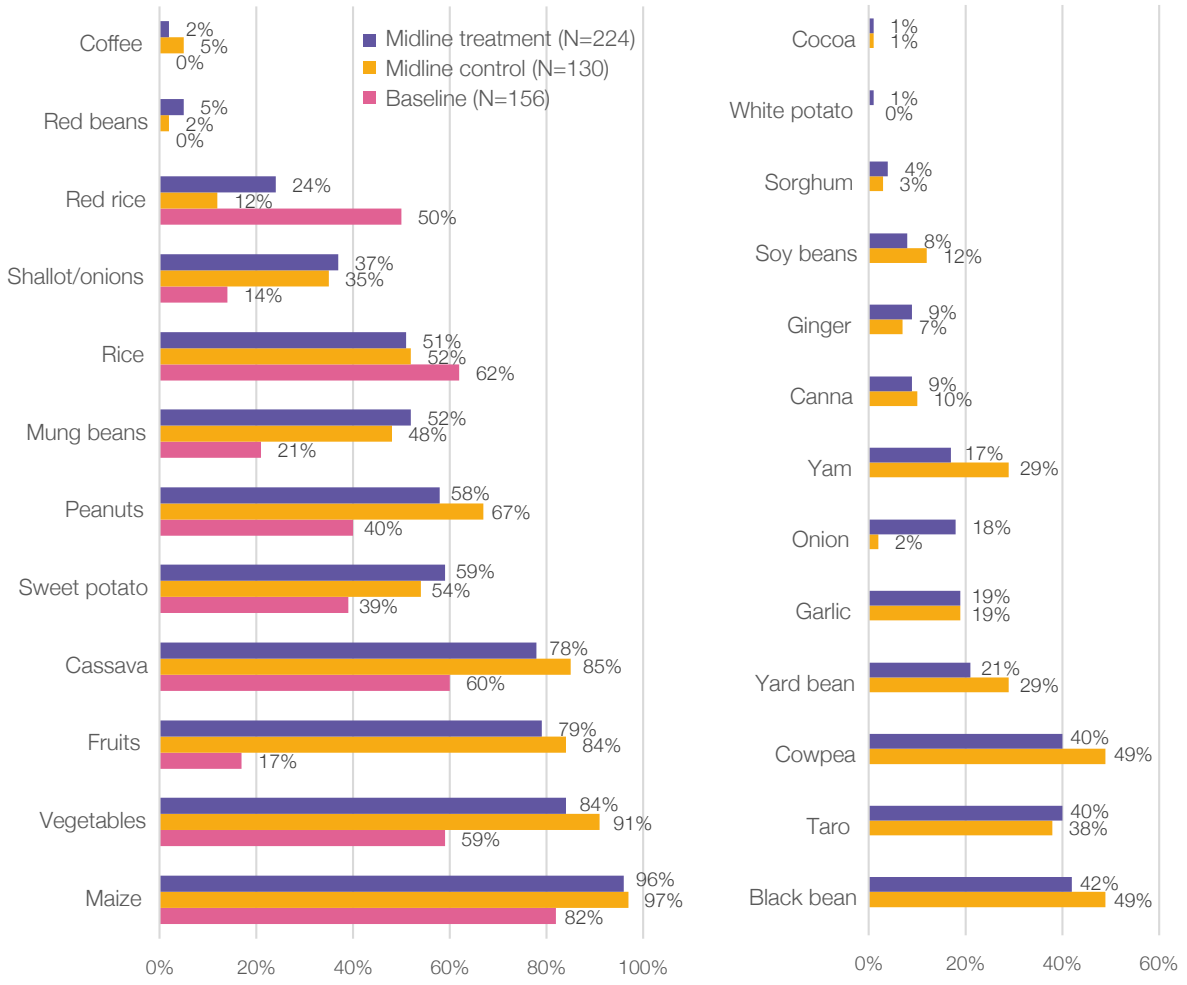
	% likely to be living under 1.25$/day	% likely to be living under 2.50$/day
	N=180	N=180
T1 (poorest)	21%	77%
T2	20%	76%
T3 (wealthiest)	15%	68%

3.2. Agricultural profile of respondents

3.2.1. Variety of crops grown in the last 12 months

The midline survey questionnaire included an exhaustive list of crops, detailing the different types of carbohydrates, pulses, vegetables, fruits and spices. These were combined into more general categories in order to provide variables that could be compared with the data collected at baseline. For crops that were not included in the baseline survey, only comparison between midline treatment and control groups was possible (see second part of Figure 2).

Figure 2. Proportion of HHs producing crops[7]



Among midline respondents, the most commonly grown crop was maize, followed by vegetables, fruits and cassava. Important differences between baseline and midline (for fruits, vegetables and sweet potatoes for example) are most likely an effect of how the midline questions were built compared to the baseline: at midline, different types of fruits, vegetables and sweet potatoes were detailed one by one.

The proportions of HHs growing the target VC crops have significantly increased, except for red rice farming which may have been affected by severe drought and erratic rainfall in 2020. Similar trends can be observed in the control and midline groups, which suggests this increase is not only a result of TOMAK's intervention.

For red rice, comparison with the baseline is not possible because data is missing for part of the baseline stage. Yet, statistically more farmers reported growing red rice among the midline treatment group than among the control group, suggesting that TOMAK has contributed to this increase.

[7] Statistically significant BL/MLt: * peanuts and rice; ** maize, vegetables, cassava, sweet potato, mung bean, shallot/onions; *** fruits. Statistically significant MLt/MLc: * red rice and yam; ** onion.

Table 13 presents midline farmers' answers regarding their three most important crops. As expected, maize and white rice were the most or the second most important crops for nearly all farmers. These were followed by peanuts, cassava and mung beans.

Table 13. Farmers' ranking of their three most important crops (only those above 10% included)

Most important crop	Second most important crop	Third most important crop
N=354	N=352	N=341
Maize: 45%	Maize: 23%	Mung beans: 16%
White rice: 27%	White rice: 13%	Cassava: 13%
	Peanuts: 12%	Maize: 13%
	Cassava: 11%	Peanuts: 11%
	Mung beans: 11%	

More interestingly, Table 14 presents the proportion of each group of expansion farmers considering the VC crop as their first, second or third most important crop.

Table 14. Proportion of expansion farmers ranking the VC crop in first, second or third position, by VC

Crop	N	Most important crop	Second most important crop	Third most important crop	Combined most / second / third
Mung beans	79	24%	11%	29%	64%
Shallot/onions	65	37%	14%	15%	66%
Red rice	24	4%	67%	25%	96%
Peanuts	56	11%	14%	34%	59%

About two thirds of expansion farmers consider that the crop they have adopted after being exposed to TOMAK activities has now become one of their most important crops. About one third of mung bean, shallot/onion and peanut expansion farmers did not include the VC crop in their top 3 crops. This could suggest these farmers are still experimenting with these new crops.

3.2.2. Variety of crops sold in the last 12 months

Respondents were then asked if they had sold some of their harvests. Results are presented in Table 15.

Table 15. Proportion of HHs selling the grown crops (% among crop growers)

Crop	N	Baseline	Midline		Stat. significant	Stat. significant
	BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Shallot/onions	**21/45/81**	**100%**	**84%**	**89%**	NS	NS
Mung beans	**33/61/114**	**94%**	**84%**	**83%**	NS	NS
Vegetables	92/114/185	76%	78%	83%	NS	NS
Peanuts	**63/87/128**	**98%**	**83%**	**75%**	**	NS
Fruits	29/105/171	76%	69%	73%	NS	NS
Red beans	0/3/10		67%	70%	NS	NS
Sweet potato	85/69/131	58%	54%	64%	NS	NS
Red rice	**60/15/53**	**100%**	**53%**	**53%**	***	NS
Cassava	93/108/169	59%	55%	47%	NS	NS
Rice	96/65/111	64%	26%	38%	**	NS
Maize	128/120/206	53%	43%	35%	*	NS
White potato	-/0/2			100%	NS	NS
Onion	-/3/39		100%	87%	NS	NS
Garlic	-/23/41		83%	85%	NS	NS
Yard bean	-/37/47		76%	72%	NS	NS
Soy beans	-/15/17		27%	65%	NS	**
Black bean	-/62/94		60%	60%	NS	NS
Cowpea	-/64/89		55%	58%	NS	NS
Ginger	-/9/19		22%	47%	NS	NS
Taro	-/49/89		39%	42%	NS	NS
Yam	-/38/39		16%	33%	NS	NS
Sorghum	-/3/8		67%	25%	NS	NS
Canna	-/13/19		23%	21%	NS	NS
Coffee	0/7/5		14%	0%	NS	NS
Cocoa	-/1/2		0%	0%	NS	NS

Interestingly, shallot/onions, mung beans and peanuts were among the most commonly sold crops, which confirms their high commercial potential. On the other hand, only 53% of red rice growers sold their harvest, perhaps due to lower volumes produced in 2020.[8]

[8] At baseline, no data on volumes of red rice and peanut produced was collected which prevents proper comparison with midline results.

Table 16 (indicator 48 of the MELF) presents similar data but only among producers who were part of each of these four VC interventions (Table 16 includes all producers, also those who grow shallot/ onions, mung beans, peanuts and red rice on their own).

Table 16. Proportions of HHs that are selling produce (by crop)

Crop	N	Baseline	Midline		Stat. significant	Stat. significant
	BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Mung beans	16/47/79	100%	98%	87%		NS
Shallot/onions	20/35/64	100%	89%	95%		NS
Red rice	60/9/24	100%	78%	75%		NS
Peanuts	60/39/56	100%	90%	91%		NS

A very large majority of expansion farmers sold their harvest in 2020. At midline stage, the VC crop that was less frequently sold was red rice (75% of expansion farmers sold their harvest). Rice is consumed daily in most households which could explain why some farmers might not necessarily want to sell their harvest - especially if volumes produced were only enough to cover own consumption, which was the case in 2020 as explained earlier.

At baseline, it was part of the sampling criteria that all respondents grow and sell the value chain, therefore it is not possible to make comparisons with the baseline data.

Note that no significant difference was observed between treatment farmers with a disability and others (about 90% of both types of beneficiaries were able to sell their harvest in 2020).

3.2.3. Total land cultivated

Information on the size of the total land cultivated was collected at baseline and midline stages but in different ways: using categories of land size at baseline and actually asking the size of the land at midline (total number of hectares or width x length). This difference in methodology could impact on the reliability of the baseline/midline comparisons. Results are presented in Table 17.

Table 17. Total land cultivated at baseline and midline, by category[9]

Category of land size	Baseline	Midline	
		Control	Treatment
	N=156	N=64	N=125
0.01 to 0.149 ha	1%	2%	0%
0.150 to 0.299 ha	3%	17%	8%
0.3 to 0.499 ha	26%	3%	1%
0.5 to 0.99 ha	23%	8%	10%
1 ha or more	48%	70%	82%

Overall, expansion farmers reported large areas of cultivation: 82% grow 1ha or more. This was not very different from control farmers (70%). But land sizes were significantly higher at midline compared

[9] 165 midline respondents were not able to answer the questions on land size.

to baseline,[10] which could be a matter of questioning methodology which differed between the two assessments.

Table 18 looks at midline respondents only and uses more precise measurements than what is presented above (categories of land sizes). The average size of cultivated land was 1.5ha among treatment respondents and 1.2ha among control farmers. Baucau was the municipality where treatment farmers cultivated the largest areas, significantly larger than control farmers. It is also where most rice producers were found, which probably explains this difference with other municipalities.

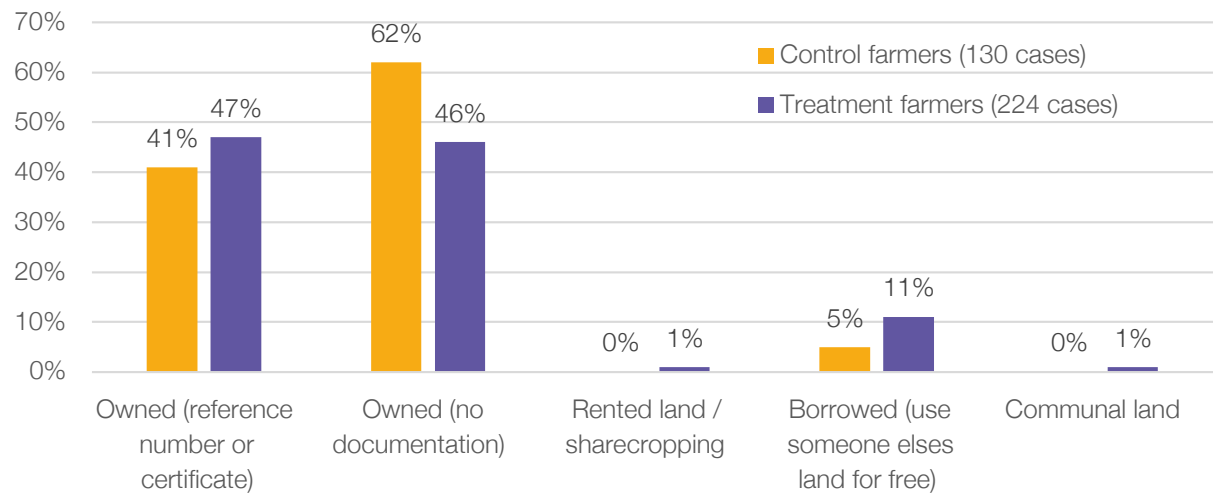
Table 18. Average land size cultivated at midline (m^2), by municipality

Municipality	Control		Treatment		Stat. significant
	N	Average	N	Average	MLt/MLc
Baucau	14	10,236	35	18,474	*
Bobonaro	39	13,851	75	13,364	NS
Viqueque	11	7,536	15	11,433	NS
Overall	64	11,975	125	14,563	NS

Note that when looking at the WI terciles, there appears to be a clear correlation with the size of cultivated land: 11,671m^2 on average among the poorest tercile, 14,116m^2 among T2 farmers and 14,903m^2 among the wealthier farmers. This seems to confirm the reliability of the WI.

During the midline survey, respondents were asked about land ownership. Results are presented below.

Figure 3. Land ownership, by control/treatment (multiple answers possible[11])



Farmers most commonly stated that they own the land where they farm, but often do not have any certificate or other document proving their land ownership. Note that the control farmers were significantly more likely to be in such a situation, whereas treatment farmers were significantly more likely to borrow / rent the land they were using.[12]

[10] Chi-square test: $p<0.05$.
[11] Respondents could select more than one answer in case they had several pieces of land.
[12] Chi-square test: $p<0.05$.

3.2.4. Respondents' perception on farming

In order to respond to the MELF key evaluation sub-question "To what extent have farmer self-perceptions changed towards farming as a respectable vocation?", respondents were asked whether they agreed or not with the following statements (Likert-scale options):

- Farming provides me with sufficient income to support my family.
- I would like my children to become farmers when they finish school.

Respondents agreeing (or "strongly agreeing") with any of these two statements were considered positive for this indicator. Note that this indicator was established after the baseline was conducted and thus, no baseline data was collected for this indicator.

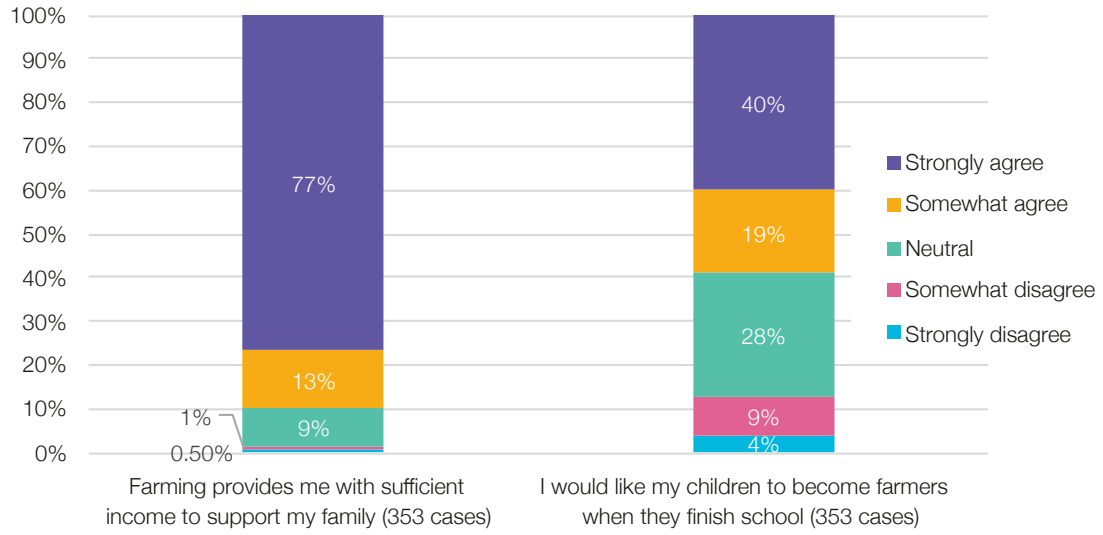
Table 19. Instances of farmers who see a future in farming

	% of farmers who see a future in farming	
	N	Average
Overall	**353**	**91%**
By program target:		
Control	130	90%
Treatment	223	91%
By VC of treatment farmer:		
Mung bean treatment farmers	79	92%
Shallot/onion treatment farmers	64	94%
Red rice treatment farmers	24	83%
Peanut treatment farmers	56	89%
By gender of treatment farmer:		
Male treatment farmers	129	92%
Female treatment farmers	94	90%
By disability of treatment farmer:		
No disability treatment farmers	163	89%
Light disability treatment farmers	60	97%
Significant disability treatment farmers	1	100%

The proportion of respondents perceiving farming as a promising activity was very high: 91%. There were only minor differences between control and treatment respondents as well as between men and women or between respondents' disability status. Some differences were observed between VCs, with shallot/onion farmers being the most optimistic about farming (94%) and red rice farmers being slightly less convinced (83%).

As shown in Figure 4, expansion farmers overwhelmingly agreed with the first statement that farming provides sufficient income to support the family. Yet, 41% of the respondents were either neutral or disagreed with the statement saying that they wished for their children to become farmers as well.

Figure 4. Proportion of midline respondents agreeing with statements on the vocation of farming



3.2.5. Animals raised and why

In order to gather information on HH wealth, questions about the ownership of animals were asked. Note that no information on animal raising was asked during the baseline.

Table 20. Animal raising among midline respondents[13]

Animal	N	% of respondents raising	Average # of animals raised (among owners)	Reasons for raising (% among owners)			
				To eat	To sell	Lia[14]	Working animal
Chickens	352	92%	16	97%	96%	4%	
Pigs	352	57%	3	27%	95%	93%	
Cows	352	54%	6	15%	92%	92%	
Goats	352	43%	5	28%	97%	91%	
Buffalos	352	12%	6	20%	98%	93%	
Fish	352	11%	270	95%	56%		
Horses	352	9%	3	9%	78%	84%	22%
Ducks	352	5%	4	88%	63%		
Sheep	352	4%	11	38%	100%	86%	5%
Dogs	352	79%	2	50%	51%	1%	1%

The most commonly raised animals were chickens (92% of all midline respondents). The average number of chickens per household was 16, which were mainly used to eat or sell. Other commonly raised animals were pigs, cows, goats and dogs which were raised by about half of the midline respondents. These bigger animals were mainly used to sell or for lia. All other farm animals listed were raised by a much smaller proportion of respondents.

[13] Control and treatment farmers.
[14] *Lia* refers to cultural ceremonies and practices. It often involves providing an animal for exchange or consumption at a cultural ceremony or event like a wedding or funeral.

No significant difference was noted between control and treatment farmers, with the exception of fish (15% of treatment farmers raise fish vs. 4% among control farmers). This may relate to geographical differences between the treatment and control areas, as fish farming can be very localised to certain sukus/aldeias and requires access to a good water source.

3.3. Production of value chain crops

3.3.1. Land cultivated

Information on the size of land cultivated under the VC crops was collected in both baseline and midline, but using very different approaches.

In the baseline, this was done by asking what proportion of the total land is used for the VC crop (total land itself was reported using categories).[15] While in the midline, a more detailed questioning was followed, asking the size of each plot under the VC crop or the total size of the area under the VC crop.[16] For shallot/onions, midline respondents reported on the number of beds grown and the length of each bed which resulted in much more detailed information than what was done at baseline. Thus, for shallot/onions especially, no comparison with baseline should be made.

Results are presented in Table 21. However, 193 midline farmers said they did not know how much land they used for their VC crop and nine gave abnormal measurements that had to be excluded. Thus the midline data here represents only 43% of all the midline respondents.

Table 21. Average size of land cultivated under VC crops (m²)

Crop	N	Baseline	Midline		Stat. significant	Stat. significant
	BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Mung beans	15/11/31	1,900	4,950	3,045	NS	NS
Shallot/onions	20/9/45	1,678	105	123	NS	NS
Red rice	60/4/16	3,238	5,264	4,996	NS	NS
Peanuts	60/8/28	1,551	874	3,325	*	*
All	**155/32/120**	**2,254**	**2,630**	**2,275**		

Overall, the cultivated areas for mung beans, red rice and peanuts have increased since the baseline. For peanut expansion farmers (over 3,000 m² cultivated), differences with the baseline data and control group data were statistically significant. This suggests that most of the increase in the peanut area was induced by TOMAK's intervention.

Note that among the 100 shallot/onion producers interviewed during the midline, 22% declared that they grew two to three cycles in the past year. No significant difference was observed between control and treatment farmers.

[15] The total cultivated land in the baseline was collected using categories of land sizes (i.e. 0.01ha to 0.149ha / 0.150ha to 0.299ha / etc.). In order to get an actual value of the total land size (which is needed to then calculate the area under the VC crop), the consultant used the middle points for each of these categories.

[16] For 14% of the midline respondents, part of the data about the size of plots used for VC crops was missing. In such cases, estimations had to be made based on the existing data and in consultation with TOMAK's team and enumerators.

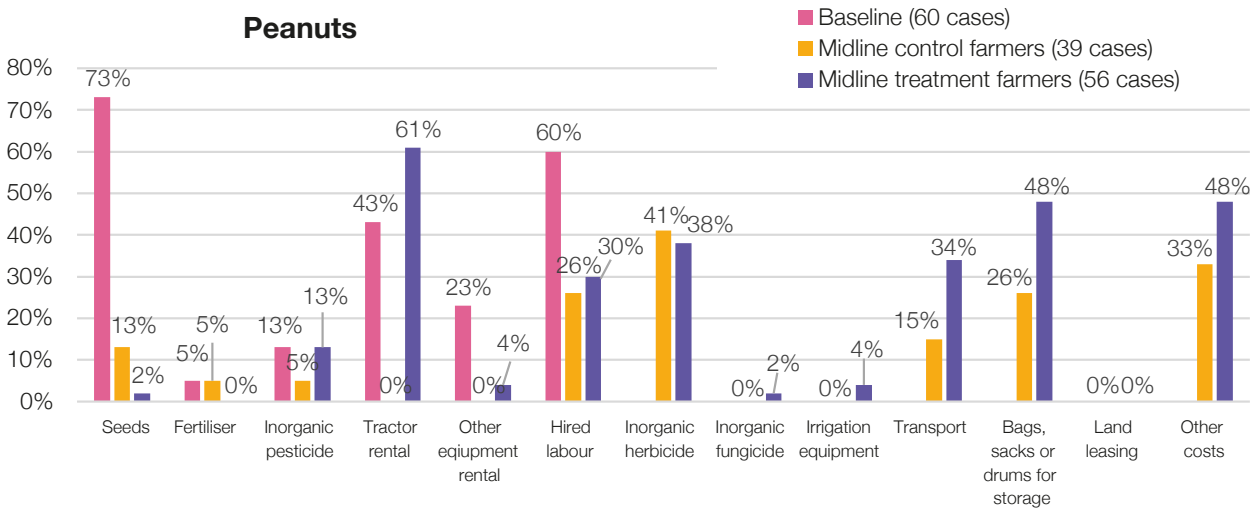
3.3.2. Production costs

Farmers were asked what type of costs they had for the production of their VC crop and how much they spent for each of these costs. Based on this, an average cost/ha was calculated for each crop. Production cost data collected during the shallot/mung bean baseline were general for all the crops grown by respondents and were therefore not used in this analysis. Also, the variety of costs for which data was collected was more extensive in the midline compared to the baseline.

Types of costs reported at baseline and midline

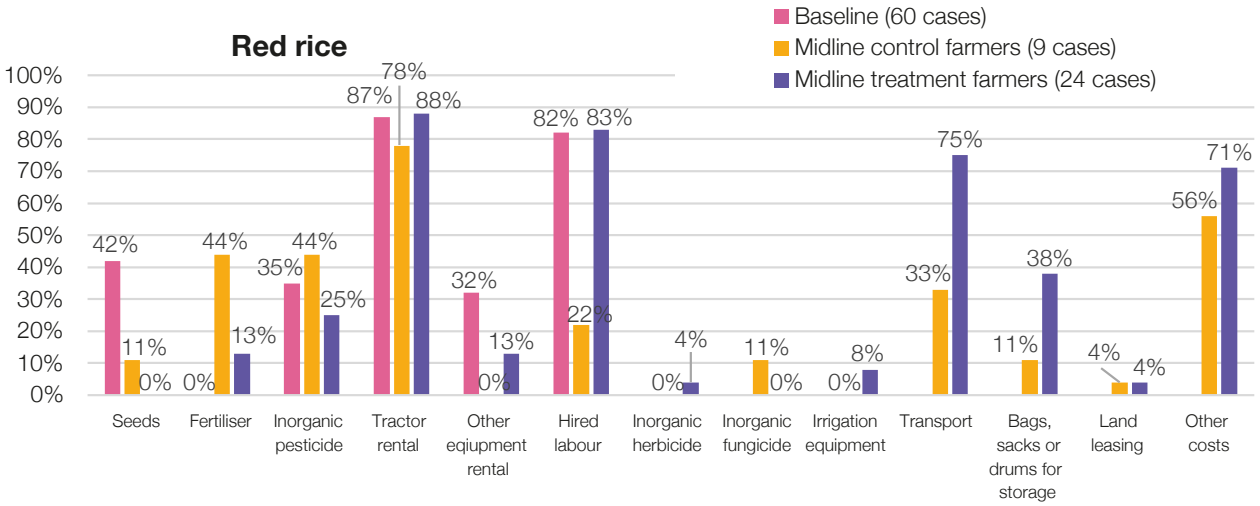
Figure 5 presents the proportion of farmers at midline (and baseline for peanuts and red rice) who reported bearing each of the different crop production costs.

Figure 5. Production costs items by VC



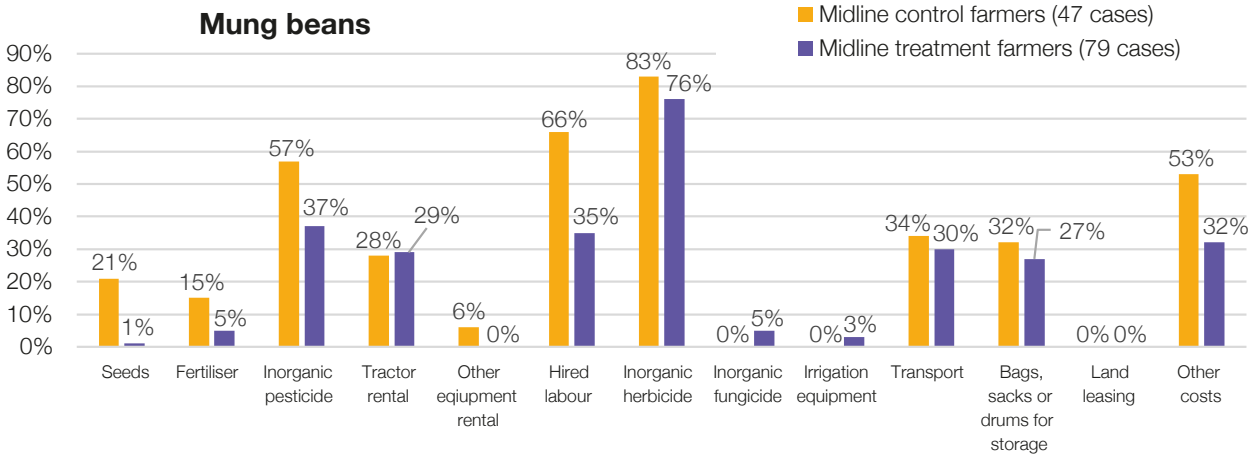
Main observations (peanuts):

- Seeds: treatment farmers benefited from subsidised seeds while baseline farmers had to buy seeds.
- Other equipment rental: significantly smaller at midline.
- Hired labour: significantly smaller at midline.
- Other differences were not statistically significant.
- Tractor rental/ transport/storage containers: significantly more midline treatment farmers reported these costs compared to control midline farmers.



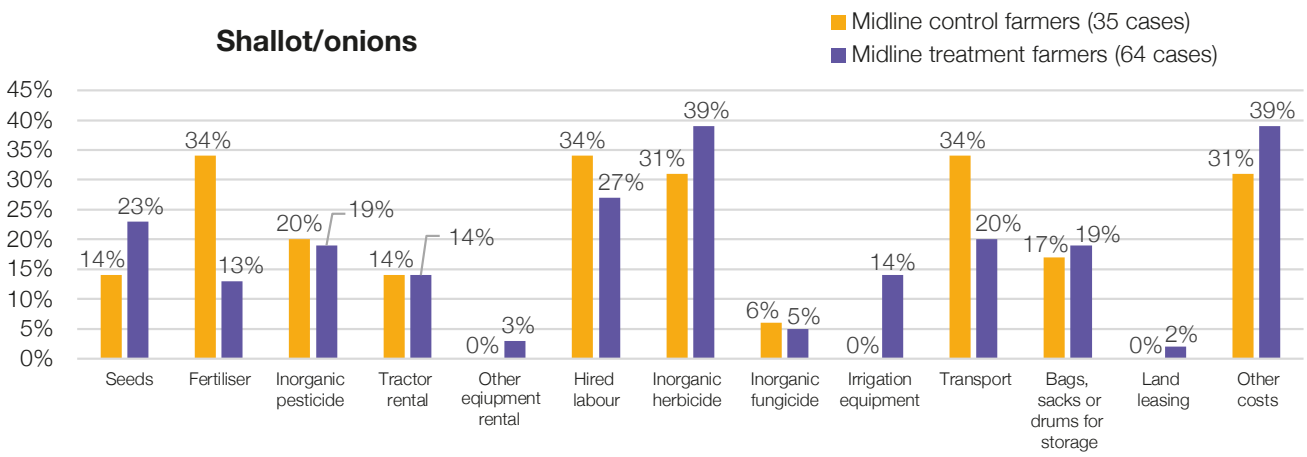
Main observations (red rice):

- Seeds: significantly more baseline respondents spent money on seeds. Other differences were not statistically significant.
- Farmers using fertilisers were either using organic or inorganic fertilisers (similar proportions).



Main observations (mung beans):

- Significantly fewer midline treatment farmers reported seeds/pesticides/hired labour as production costs compared to control farmers.
- The fertilisers used by mung bean farmers were all inorganic.



Main observations (shallot/onions):

- Significantly fewer midline treatment farmers reported fertilisers as a production cost compared to control farmers.
- Farmers using fertilisers were either using organic or inorganic fertilisers (similar proportions)

Average amounts spent by type of costs

Table 22 compares the average amounts per farm reported by midline control and treatment farmers for each type of production cost.

The most expensive production costs were often for labour and rental of tractors. Inorganic fertilisers were also among the important production costs, especially for red rice. None of the differences between control and treatment farmers were statistically significant (sample sizes often too small to enable valid comparisons) besides for the cost of labour for peanuts.

Note that “other costs” sometimes included food for labourers or traditional harvest ceremonies, and thus also represented a significant amount of money for some farmers.

Table 22. Average amounts spent by grouped categories of costs and VC per farm (USD)

Type of production cost	Mung beans				Shallot/onions			
	Control		Treatment		Control		Treatment	
	N	Mean	N	Mean	N	Mean	N	Mean
Land preparation (land leasing/tractor)	13	38	23	33	5	26	10	41
Seed	10	13	1	10	4	19	14	15
Fertilisers (inorganic and organic)	7	13	4	19	12	29	8	34
Pesticides/fungicides/herbicides	37	23	56	19	14	13	28	15
Hired labour	30	42	28	30	12	25	16	28
Equipment (irrigation + other rentals)	3	20	2	20	0		10	38
Post-harvest costs (storage, transport)	24	12	35	17	14	10	17	15
Other costs	25	12	25	13	11	7	25	20

Type of production cost	Red rice				Peanuts			
	Control		Treatment		Control		Treatment	
	N	Mean	N	Mean	N	Mean	N	Mean
Land preparation (land leasing/tractor)	7	53	21	103	0		34	60
Seed	1	15	0		5	21	1	15
Fertilisers (inorganic and organic)	4	61	3	58	2	N/A	0	
Pesticides/fungicides/herbicides	4	12	7	9	15	11	18	12
Hired labour	2	40	19	64	9	25	17	49
Equipment (irrigation + other rentals)	0		3	29	0		4	11
Post-harvest costs (storage, transport)	4	19	21	24	13	7	31	20
Other costs	5	47	17	36	13	13	27	22

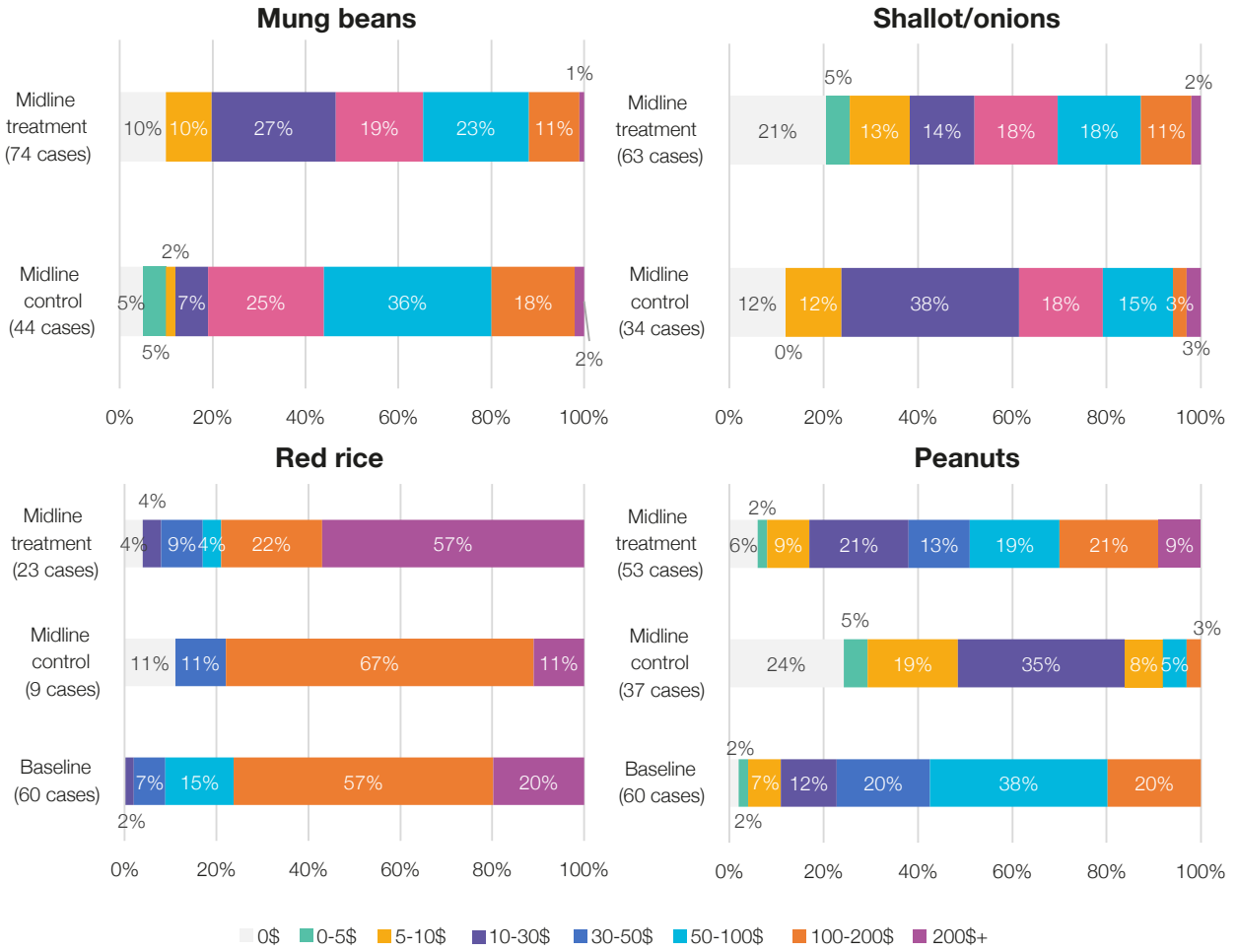
A number of issues should be kept in mind in regards to reported production costs including that:

- It is very likely that the costs for tractors include land also grown with other crops.
- For inorganic pesticides and herbicides, some farmers bought products in bulk for several crops but declared the whole price during the interview.
- For farmers having reported the area of VC crop grown, it was possible to verify if the stated cost of certain expenses (tractor, herbicides, seeds, fertilisers) was coherent compared to the area grown. Incoherent costs were excluded from the above analysis.

Total production costs per farm and per hectare

Comparison with baseline data was done using categories of total production costs per farm, as this is how the information was collected at baseline stage (see Figure 6).

Figure 6. Total production costs per farm by category



At baseline and midline, red rice remained the crop with the highest production costs per farm. Expansion farmers reported higher production costs compared to baseline and control farmers, which may demonstrate increased willingness to invest more in crop production in order to get higher returns at harvest.

The situation was similar for peanuts: production costs per farmer were higher among treatment farmers than among control and baseline producers. Yet, as data collection methods differed significantly between surveys, these comparisons are less reliable.

It should be noted that for mung beans, the main GAP improvement that TOMAK recommends is for farmers to plant the mung bean varieties Kiukae and Vima, which can both be harvested at one time during the season, thereby reducing harvest labour costs significantly, whereas other costs remain the same. Varieties used previously needed to be harvested three to four times during one season. Average production costs per farm and per hectare were calculated for control and treatment farmers (Table 23) using the more precise data collected during the midline. As many respondents reported abnormal amounts for tractor rental even though the cost is generally quite standard, the tractor costs reported by farmers were replaced with the standard cost (110USD/ha including fuel).[17]

[17] Replacing tractor costs reported by farmers by standard tractor rental costs was possible only for farmers for which the size of VC crop cultivated was known.

Note that the production cost per hectare could only be calculated for farmers who were able to provide information on the area grown, which was the case for only 36% of mung bean farmers, 58% of shallot/onion farmers, 61% of red rice farmers and 39% of peanut farmers.

Table 23. Average production costs per farm and per hectare

(1) Average production cost per farm (USD)					
Crop	Control		Treatment		Stat. significant
	N	Average	N	Average	MLc/MLt
Mung beans	44	72	74	47	*
Shallot/onions	34	35	63	41	NS
Red rice	9	117	23	217	*
Peanuts	37	20	53	82	*

(2) Average production cost per hectare (USD/ha)					
Crop	Control		Treatment		Stat. significant
	N	Average	N	Average	MLc/MLt
Mung beans	12	351	34	271	NS
Shallot/onions	11	3,575	51	3,883	NS
Red rice	4	637	16	959	NS
Peanuts	11	65	27	427	*

When looking at the production costs per farm, farmers spent the highest amounts to produce red rice: up to 217USD/farm for expansion farmers. This was significantly more than the amount spent by control farmers (117USD/farm). As per Table 23, most of this cost was spent on tractor rental and labour, which were both smaller costs among control farmers.

Production costs per farm for peanut producers were much higher among treatment farmers, which reflects the much larger areas of peanuts being grown among expansion farmers (4 times larger – Table 22).

The average production cost per farm for shallot/onion was the smallest (41USD/farm) even though it is by far the highest per hectare with close to 4,000USD needed for 1 ha, due to the wide variety of inputs needed (more costly seeds, labour, fertilisers, tractor rental and irrigation for treatment farmers). This result reflects TOMAK's own estimations of production costs per hectare for shallot/onions. As farmers often grow 10 to 15 beds (about 120-180 m^2) of shallot/onions, production costs represent less than 60USD for most farms.

Red rice was the second most costly crop per hectare: close to 1,000USD/ha among treatment farmers. This was significantly higher than TOMAK's estimations.

Mung beans and peanuts were reported as the least costly VC crops per hectare. Very little fertiliser is needed for these two crops[18] and only a few farmers apply pesticides/herbicides on peanuts.

Besides for mung beans, production costs were higher among treatment farmers than among control farmers which reflects farmers' increased willingness to invest when following improved practices.

[18] Legumes are capable of obtaining nitrogen by air and so do not need nitrogen fertilisers.

But again, such quantitative data should be interpreted carefully as many farmers were not able to provide information on their land size, especially among control farmers (72% of control farmers did not provide information on the size of the VC crop cultivated vs. 44% of treatment farmers).

Production costs compared to value of production (i.e. profit)

In order to better compare these production costs, Table 24 presents production costs compared to the production value or income (production values presented later in Figure 7), in other words, the profit.

Results are presented per farm and per hectare.[19] Because many farmers were not able to estimate the size of the land cultivated with the VC crop, profit per hectare was calculated among only 17% of the control farmers and 42% of the treatment farmers and thus, might not reflect realistically the differences between control and treatment farmers.

Table 24. Average profit per farm and per hectare

(1) Average profit per farm (USD)					
Crop	Control		Treatment		Stat. significant
	N	Average	N	Average	MLc/MLt
Mung beans	43	370	71	353	NS
Shallot/onions	25	367	46	353	NS
Red rice	9	272	21	236	NS
Peanuts	37	369	51	716	NS

(2) Average profit per hectare (USD/ha)[20]					
Crop	Control		Treatment		Stat. significant
	N	Average	N	Average	MLc/MLt
Mung beans	8	1,125	25	1,363	NS
Shallot/onions	6	35,552	33	25,490	NS
Red rice	2	190	12	762	NS
Peanuts	6	3,071	23	2,497	NS

Only the the average profits among treatment farmers are commented on as these represent a higher portion of the sample interviewed and are more likely to represent the real trend.

Firstly, when looking at the profit per hectare, all of the VC crops appear to have been highly profitable except for red rice which has a lower value than other crops. Shallot/onions have a very high return on investment: even though production costs are the highest (close to 4,000USD/ha), the income generated is about six times higher. With small areas cultivated only (123m^2 on average – Table 21), expansion farmers are able to generate up to 353USD per farm.

Peanuts have the second highest average profit per hectare (2,497USD/ha) followed by mung beans (1,363USD/ha). Peanut expansion producers are those earning the highest profit per farm (716USD): high volumes produced (Table 25) with an interesting value (1.23USD/kg).

[19] Results per hectare are available only for farmers who were able to inform enumerators about the size of the cultivated plots.
[20] Results exclude all farmers for which productivity data was beyond the established thresholds (see following subsection 3.3.3-2 on productivity).

3.3.3. Production volumes, productivity and value

Production volumes and values per farm

Volumes produced per farm were collected by asking to farmers how many sacks/drums/etc. they harvested and then converting these units into kilograms. Unfortunately, no information on volumes produced by red rice and peanut farmers was collected during the baseline and volumes produced by 24 shallot/onion producers is missing at midline.

As discussed in section 2.5 (limitations), collecting reliable data on volumes is a challenge and results should be interpreted very carefully.

Table 25. Average volumes produced per farm, by VC (kg)

Crop	N	Baseline	Midline		Stat. significant	Stat. significant
	BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Mung beans	16/46/76	200	289	265	NS	NS
Shallot/onions	20/26/48	242	272	272	NS	NS
Red rice	-/9/22	N/A	778	950	NS	NS
Peanuts	-/39/54	N/A	331	645	NS	*

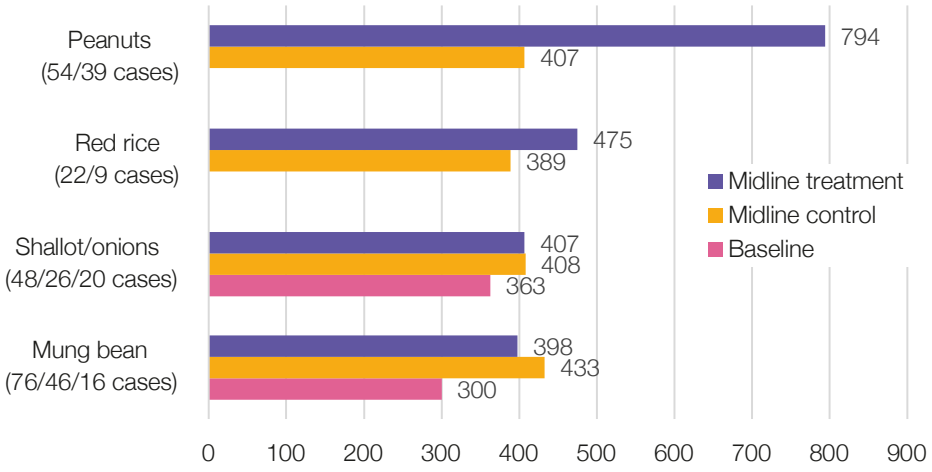
Volumes produced for red rice and peanut were much higher among treatment farmers than among control farmers. Especially for peanuts, this difference (close to double) is statistically significant: 645kg vs 331kg among control farmers. As sample sizes were quite large for peanuts (with no major issues with the data), it is likely that this difference in volumes produced is well representative of how much peanut expansion farmers have been able to progress since their involvement in the program.

The volume of mung beans has increased since the baseline in both treatment and control group suggesting the increase was not only induced by the program intervention. For shallot/onions, the fact that data were missing for 24 midline farmers makes interpretation too hazardous.

Consultation with the program team on these figures confirmed that these volumes are likely to be under the real production volumes observed by TOMAK's field staff. Among the farmers supported by TOMAK, shallot/onion expansion farmers are among the most optimistic and happy with their harvest results, having invested a lot of time and money in their production, with a noticeable impact on their production volumes. This clearly raises concern on the reliability of the collected volume data as a whole.

Figure 7 presents the average values of the volumes produced per farm.

Figure 7. Average values of production per farm, by VC (USD)[21]



Among farmers for which the value of production could be calculated, peanut expansion farmers were those earning the highest incomes by far: USD794 vs. USD475 for red rice and about USD400 for mung bean and shallot/onions. Note that the difference between control and treatment peanut producers is the only statistically significant difference.

Yield per hectare

Productivity could only be calculated for 35 mung bean and shallot/onion baseline farmers[22] and 139 midline farmers. Indeed, for the midline, areas cultivated for VC crops was unavailable for more than 200 farmers[23] and 24 shallot/onion producers were not able to estimate the volumes harvested. Clearly, the missing data on area is a limiting factor in this survey as the volumes and production costs cannot be assessed properly if these data are not available.

Note that in order to exclude unreliable productivity data, the following minimum and maximum thresholds were established by TOMAK's Component 2 team:

- Mung beans: minimum 200kg/ha / maximum 5T/ha
- Shallot/onions: minimum 500kg/ha / maximum 50T/ha
- Red rice: minimum 200kg/ha / maximum 8T/ha
- Peanuts: minimum 200kg/ha / maximum 6T/ha

As a result, 27 out of the 174 farmers for which productivity could be calculated were excluded for being below or above these thresholds. Data from the remaining 147 farmers is presented in Table 26.

As a comparison, at the time of the baseline survey, FAO estimated the productivity of TOMAK's target crops as follows: 1,069kg/ha for mung bean, 2,128kg/ha for shallot/onion, 1,200kg/ha for red rice and 1,247kg/ha for peanuts. These values were used to report on productivity in the baseline reports.

[21] Cases reported in brackets for midline treatment, midline control and baseline samples respectively.
[22] No information was collected on volumes produced for red rice and peanut farmers.
[23] 195 respondents said they did not know how much area they grew and seven reported abnormally high land sizes.

Table 26. Average productivity, compared to baseline and control group (kg/ha)

Crop	N BL / MLc / MLt	Baseline	Midline		Stat. significant BL/MLt	Stat. significant MLt/MLc
			Control	Treatment		
Mung beans	15/9/26	1,451	900	1,178	NS	NS
Shallot/onions	13/6/34	3,235	25,614	19,726	*	NS
Red rice	-/2/13	N/A	550	2,463		NS
Peanuts	-/6/23	N/A	2,594	2,262		NS

For shallot/onions, the above data shows a very important increase in productivity since the baseline (six times) while mung bean productivity decreased slightly. It is important to keep in mind that the mung bean/shallot/onion baseline sample size was insufficient.

If FAO estimations are used instead of the baseline data, it appears that the productivity has actually increased for all four VC crops: a very strong increase for shallot/onion (nine times), followed by red rice and peanut (about twice as much) and mung beans (a slight increase only).

On the other hand, comparison of productivity between control and treatment farmers shows improved productivity for mung beans and red rice but smaller productivity for shallot/onions and peanuts. Productivity could be calculated for only 18% of the control farmers and 43% of the treatment farmers, which severely impacts on the comparability of these averages.

Number of TOMAK supported HHs reporting increased income from agricultural sales

Table 27 presents the average values of production by categories. A minimum of USD100 is used as the benchmark to determine whether farmers are earning sufficiently from their production or not.

Table 27. Number of treatment farmers per value of production range, compared to baseline

Value of production per farmer	Mung beans		Shallot/onions		Red rice	Peanuts
	Baseline	Midline	Baseline	Midline	Baseline	Midline
	N=16	N=76	N=20	N=48	N=22	N=54
$ 0-100	2	16	6	7	0	11
$ 101-200	7	18	5	13	2	7
$ 201-500	4	19	2	17	11	9
$ 501-1000	2	17	6	7	8	7
$ 1001-2000	1	5	1	2	1	14
$ 2001 +	0	1	0	2	0	6
% of farmers with production values of $100 or more	88%	80%	70%	85%	100%	80%

At the midline stage, more than 80% of the expansion farmers interviewed for which such data could be calculated, earned more than $100 from their VC production. Interestingly, all the red rice producers in the midline earned at least $100.

This is an improvement compared to the baseline stage for shallot/onion farmers but not for mung bean farmers. But again, sample sizes for those two crops at baseline were fairly small and data most likely not representative.

3.3.4. Agricultural practices

An extensive set of questions was included in the midline questionnaire to collect information about farmers' practices, some of which are GAPs promoted by TOMAK during FFS. For some of these practices, baseline data was also available.

As explained earlier, the reliability of the quantitative data on production and productivity is fairly limited. Therefore, understanding how farmers' practices have evolved is crucial to be able to better assess the impact of TOMAK's intervention as the GAPs being promoted to farmers are intended to increase production and productivity. More detailed research work is still needed on demplots to provide further data on this (which GAPs are having the highest impact and % increase productivity/ GAP).

In this section, the practices that were included in the midline survey are analysed to observe possible differences with the baseline and control groups (part 1). This is followed by an examination of GAPs only (part 2) in order to form a "GAP Index", which is useful to understand how closely farmers complied with the packages of good practices. Part 3 explores the inputs needed to apply these GAPs and how farmers have been able to source them. Lastly, the gender division of labour for each of these agricultural practices is discussed (part 4).

1. Farmers' agricultural practices

Agricultural practices promoted by the program (GAPs) are highlighted in grey in the following tables. Values presented here for these practices are part of the reporting for indicator 34 "Proportions of farmers trained applying improved practices". Besides these GAPs, the midline questionnaire included a lot more questions on farmers' practices in order to provide a wider understanding of farmers' habits (not highlighted in the tables).

Land preparation practices: At midline, the practices that were the most frequently implemented by treatment farmers were: planting shallot/onions on standard size raised beds, soil levelling for shallot/ onions and red rice, and ploughing the land with organic matter into soils and using hedgerows.

For the three practices for which baseline data were also available, there is a very important increase in the proportion of farmers planting shallot/onions on raised beds and ploughing organic matter into the soil since the baseline: from about 20% to close to about 95% at midline. However, a high proportion of control farmers also used these techniques (80-90%) meaning that only about 10% of the increase is most likely a result of TOMAK's intervention.

Using fire to clear the land was more common at midline than baseline, which is surprising as TOMAK discouraged farmers from using this technique. Yet, when compared to control farmers, it appears that the situation was better among treatment farmers. It should be noted that farmers use fire to clear the land on plots that have not been cultivated for several years; land that is cultivated on a regular basis is not suited for burning.

For other practices, comparison with control farmers showed that significantly more treatment farmers were using improved practices: shallot/onion standard bed dimensions, hedgerows, ploughing and clearing the land. Treatment farmers also ploughed the land with a tractor more frequently than control farmers. Furthermore, TOMAK is aware that expansion farmers have easier access to tractors as the AEWs can facilitate use of MAF tractors.

Clearly, TOMAK has been successful in improving farmers' agricultural practices in terms of land preparation. As practices vary a lot depending on VCs, Table 28 compares the proportion of farmers applying each of the above practices by crop.

Table 28. Land preparation practices by VC (midline treatment only)

Agricultural practice	Mung beans	Shallot/ onions	Red rice	Peanuts	Stat. significant
	N=79	N=65	N=24	N=56	
Clearing land	33%	43%	33%	59%	*
Not use burning	49%	59%	79%	34%	**
Terracing	20%	66%	38%	16%	***
Use hedgerows	72%	74%	29%	77%	**
Plough the land	39%	100%	96%	30%	***
Plough with machine (vs. manual)	81%	17%	100%	82%	***
Average number of times ploughing	1.2	1.6	2.0	1.4	NS
Plough organic matter into the soil	93%	89%	96%	93%	NS
Soil levelling		98%	91%		NS

Choice of varieties and planting practices: The vast majority of treatment farmers had adopted improved planting practices, most of which were specific to shallot/onion production: plant seeds instead of bulbs, establish nurseries on bamboo stilts, reuse mini-bulbs kept from previously planted improved seeds. On the other hand, 94% of control farmers were planting bulbs bought from local shops or kept from their previous harvests which are overall low-yielding varieties.

More than 90% of expansion farmers were growing improved seed varieties which they accessed via TOMAK and AEWs. This was especially true for peanut and shallot/onion producers, with very few control farmers reporting using improved varieties (none for peanuts and 14% for shallot/onions). The use of plastic roofing when shallot/onion seeding is done directly in the soil was limited (25% of treatment farmers), but this practice is not recommended by TOMAK anymore. On the other hand, rice seedlings were still being transplanted too late compared to TOMAK's recommendations: only 21% of expansion farmers transplanted seedlings at 8-12 days (most farmers were transplanting much later: 15 days or more). This is most likely because many farmers still believe that older seedlings are much stronger to establish in the soil and are not yet able to provide the care needed when transplanting younger seedlings.

Table 29. Planting practices compared to baseline and control group

Agricultural practice	Crop	N BL / MLc / MLt	BL	Midline Control	Midline Treatment	Stat. significant BL/MLt	Stat. significant MLt/MLc
Transplanting (vs. broadcasting)	MB/RR	-/56/103		98%	97%	NS	NS
Seed nursery	S/RR	80/44/89	78%	32%	96%	**	***
Nursery on bamboo stilts	S	-/5/61		60%	90%	NS	NS
Transplant at 8-12 days	S/RR	-/14/85		0%	7%	NS	*
Plant seeds (vs. bulbs)	S	-/35/65		6%	85%	NS	***
Mini bulbs from previous season	S	-/32/10		81%	90%	NS	NS
Direct seeding in the soil	S	-/35/65		49%	35%	NS	NS
Plastic roofing	S	-/17/23		0%	26%	NS	NS
Average # of seeds/hole	MB/P	-/86/135		2.4	2.1	NS	NS
Use Maserati, Tropix, Lokananta, or Tuk-Tuk Super improved seeds (shallot/onions)	S	-/35/65		14%	97%	NS	***
Use Inpari-24 or Nakroma improved seed (rice)	RR	-/9/24		78%	92%	NS	NS
Use Kiukae (from MAF) or Vima-3 improved seed (mung beans)	MB	-/47/79		36%	94%	NS	***
Use local seeds/tasi balu	P	-/39/56		72%	75%	NS	NS
Use Hypoma-2 improved seed (peanuts)	P	-/39/56		0%	88%	NS	***

Irrigation practices: For irrigation questions, only those related to shallot/onions were part of TOMAK's recommendations, i.e. to use drip irrigation and simple fertigation techniques (compost dissolved into the water tank where drip pipes are sourcing water from). Drip irrigation systems are still very uncommon among Timorese farmers and mostly unavailable in the market which is why TOMAK has facilitated farmers' access to subsidised drip irrigation systems for shallot/onions. As a result, 67% of the shallot/onion expansion farmers interviewed reported using drip irrigation and most of these (88%) were using it to fertilise their crop. Only one farmer during the baseline study and two midline control farmers had used drip irrigation.

Table 30. Irrigation practices compared to baseline and control group

Agricultural practice	Crop	N BL / MLc / MLt	BL	Midline Control	Midline Treat-ment	Stat. significant BL/MLt	Stat. significant MLt/MLc
Gravity irrigation for rice	RR	-/9/24		45%	50%	NS	NS
Irrigated how many days after transplanting	RR	-/5/12		3 days	4 days	NS	NS
Average number of times field was open for irrigation	RR	-/5/12		21 times	18 times	NS	NS
Drip irrigation for shallot/onion	S	20/35/64	5%	6%	67%	***	***
Fertigation	S	-/2/43		50%	88%	NS	NS

Fertilisation, pest/disease/weed management practices: The use of more sustainable practices such as mulching and organic fertilisers significantly increased from the baseline (more than 20% increase) while the use of organic pesticides remained rare: only 13% of expansion farmers (but slightly more frequent in comparison to the control group). The frequency of weeding (mostly manual) was higher among treatment farmers: 2.3 vs. 1.8 times among control farmers.

The use of chemical fertilisers was lower for expansion farmers than among control farmers (9% vs. 15% among control farmers), which has environmental benefits (for soil conservation and fertility, etc.), and may also be economically advantageous (by replacing purchased chemical fertilisers with farm-produced compost and manure). Organic fertiliser and/or compost application is however only feasible on smaller size areas (such as onion/shallot and vegetable crops), and not for large cropping areas (such as rice fields). On the other hand, the use of chemical pesticides has increased among both control and treatment farmers, suggesting this is a general trend rather than an effect of TOMAK's intervention.

Overall, TOMAK's intervention has helped to develop the use of more sustainable practices among early adopters, although 60% to 70% of expansion farmers are still not applying these improved practices.

Table 31. Fertilisation, pest/disease/weed management practices compared to baseline & control

Agricultural practice	Crop	N	BL	Midline		Stat. significant	Stat. significant
		BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Mulching	S/P	80/74/120	5%	10%	34%	**	**
Organic fertiliser	All	156/130/223	11%	21%	38%	**	*
Inorganic fertiliser	All	156/130/223	8%	15%	9%	NS	*
Organic pesticide	All	156/130/223	11%	5%	13%	NS	*
Inorganic pesticide	All	156/130/223	16%	32%	30%	*	NS
Applied pesticide after finding pests (vs. before)	All	-/37/63		51%	65%	NS	NS
Inorganic herbicide	All	-/130/223		52%	50%	NS	NS
Inorganic fungicide	All	-/130/223		3%	5%	NS	NS
Weeding	All	-/130/223		95%	93%	NS	NS
Weeding with a machine (vs. manually)	All	-/124/208		0%	1%	NS	NS
Average times weeding	All	-/124/207		1.8	2.3	NS	*

Table 32 shows how the different VC expansion farmers applied fertilisation and pest/disease management practices. Organic fertiliser was mostly used by shallot/onion producers (94% of shallot/onion producers) but may not have been required for mung bean and peanut production as these are nitrogen fixing crops (9% and 16% of mung bean and peanut farmers respectively used organic fertilisers). Inorganic herbicides were used by 77% of mung bean producers, vs. 39% and 41% of peanut and shallot/onion producers.

Table 32. Fertilisation, pest/disease/weed management practices by VC (midline treatment only)

Agricultural practice	Mung beans N=79	Shallot/ onions N=64	Red rice N=24	Peanuts N=56	Stat. significant
Mulching		36%		32%	NS
Organic fertiliser	9%	94%	38%	16%	***
Inorganic fertiliser	6%	9%	25%	4%	**
Organic pesticide	8%	20%	21%	7%	**
Inorganic pesticide	38%	20%	67%	14%	**
Applied pesticide after finding pests (vs. before)	68%	64%	56%	75%	NS
Inorganic herbicide	77%	41%	8%	39%	***
Inorganic fungicide	5%	6%	0%	5%	NS
Weeding	84%	98%	100%	96%	NS
Weeding with a machine (vs. manually)	0%	0%	4%	2%	NS
Average times weeding	2.1	2.6	2.5	2.0	*

Harvest and post-harvest practices[24]: Treatment and control farmers both had good practices in terms of harvesting crops at the right moment (when shallot/onion and peanut leaves are yellow or when mung bean pods are dry). But the duration of rice harvest was still much longer than TOMAK's recommendations: about five days instead of one to two days maximum needed to avoid moisture differences between grains in the harvest and unequal drying of grains after that. The use of rice mowers was very limited (only one treatment farmer reported using a mower among 33 rice producers interviewed).

Using machines for harvesting, threshing and shelling is still rare among both treatment and control farmers, even though slightly more frequent for shelling of peanuts among expansion farmers: seven expansion farmers had used a peanut sheller while all control farmers shelled manually.

As for storage practices, significantly more treatment farmers stored peanuts in bags that were put into drums or on pellets: 57% vs. 32% among control farmers. This improvement was most likely an effect of TOMAK's awareness-raising on proper storage practices.

[24] No baseline data available for this section.

Table 33. Harvest and post-harvest practices compared to control group

Agricultural practice	Crop	N MLc / MLt	Midline Control	Midline Treat-ment	Stat. significant MLt/MLc
Harvesting with a mower (vs. manually)	RR	9/24	0%	4%	NS
Average number of days to harvest	RR	9/24	5.6	4.6	NS
Harvest when leaves are yellow	S/P	74/120	100%	100%	NS
Harvest when pods are dry/black	MB	7/79	100%	100%	NS
Threshing	RR/MB	56/103	98%	98%	NS
Threshing with a thresher (vs. manually)	RR/MB	55/101	15%	26%	NS
Finish threshing the day crop was harvested	RR	8/22	38%	41%	NS
Drying	All	130/223	92%	87%	NS
Average number of days dried harvest	S/P/MB	111/171	3.0	3.4	NS
Store pods in bags	P	39/56	97%	95%	NS
Grain-Pro bags	P	38/53	0%	25%	**
Bags in drums/on pellets	P	38/53	32%	57%	**
Shelling	P	39/53	97%	95%	NS
Shelling with a machine (vs. manually)	P	38/53	0%	13%	**
Shelling just before selling (vs. just before eating)	P	38/53	63%	70%	NS

In Table 34, one farmer declared using a thresher for mung beans (Bobonaro, suku Batugade).

Table 34. Harvest and post-harvest practices by VC (midline treatment only)

Agricultural practice	Mung beans N=79	Shallot/ onions N=64	Red rice N=24	Peanuts N=56
Harvest when leaves are yellow		100%		100%
Threshing	100%		92%	
Threshing with a thresher (vs. manually)	6%		96%	
Average number of days dried harvest	1.6	3.4		6.0

In another section of the midline questionnaire, farmers were also asked if they had stored some of their previous harvest during the past 12 months, and if yes, how they stored their harvest. Results were as follows:

- Mung beans: sacks (74%), jerry cans (18%), silo, drum and aqua bottle (2% each).
- Shallot/onions: sacks (29%), on a raised bamboo table (28%), hanging (13%), in the ground (10%), net bag (8%), loose on the floor (6%), above kitchen stove (4%).
- Red rice: 1 tonne “hoka” (large storage basket for storing rice or corn) (67%), sack (27%).
- Peanuts: sacks (62%), drum (16%), 1 tonne “hoka” (12%) silo (7%), hanging (2%).

The most common storage was in sacks which were mostly rice sacks or coffee/sugar sacks. Only treatment farmers were using air-tight Grain-Pro bags. To reduce rodent attacks, storing in silos and drums is advisable. Note that 29% of shallot/onion producers stored their harvests in sacks which is

safe for short periods only. Hanging or laying on tables are safer practices for shallot/onions and are commonly used by both treatment and control farmers.

The above data was used to provide further details on post-harvest loss in part 3.3.6 (Use of harvests).

Rotation and intercropping: Crop rotation in a field is a means to successively exploit the different soil layers. Intercropping has similar advantages, combining the capacity of different crops to exploit the different soil layers at the same time.

The proportion of farmers rotating their VC crops increased from the baseline for both control and treatment farmers (especially among shallot/onion treatment farmers – Table 35). Thus, it is possible that this increase is part of a wider trend among farmers than as a result of TOMAK's intervention. Note that rotation for red rice (vegetables/legumes planted on the dry paddy fields during the dry or mid-season) was still very rare, probably because it requires irrigation.

No significant difference was observed with the control group in regards to intercropping mung beans. Only growing legume trees such as leucaena or gliricidia is more frequent among treatment farmers (72% vs. 51% of control farmers). TOMAK has recommended to grow legume trees that can easily be found locally to help enrich the soils and can be used as nitrogen-rich fodder for animals.

Table 35. Rotation and intercropping practices compared to baseline and control group

Agricultural practice	Crop	N	Bl.	Midline		Stat. significant	Stat. significant
		BL / MLc / MLt		Control	Treatment	BL/MLt	MLt/MLc
Rotation	All	156/130/223	14%	61%	50%	**	*
Crops used to rotate	All	-/79/111		Maize (58%), other (34%), cassava (6%), bean (1%)	Maize (53%), other (41%), peanuts (3%), cassava (2%), beans (1%)	NS	NS
Average number of seasons after which rotate crops	All	-71/100		1.10	1.07	NS	NS
Intercropping	MB	-/47/79		17%	19%	NS	NS
Intercrop with cassava/maize	MB	-/8/15		75%	80%	NS	NS
Grow legume trees	All	-/130/224		51%	72%	NS	**

Table 36. Rotation and intercropping practices by VC (midline treatment only)

Agricultural practice	Mung bean N=79	Shallot/onion N=64	Red rice N=24	Peanut N=56	Stat. significant
Rotation	46%	80%	4%	41%	***
Average number of seasons after which rotate crops	1.10	1.02		1.13	NS
Grow legume trees	81%	74%	25%	77%	**

2. GAP Index

In order to have a general sense of how closely each farmer complied with GAP practices recommended by TOMAK, a simple GAP Index was computed by calculating the proportion of GAP practices that farmers applied compared to all the GAP practices that were recommended for the respective crops.

Because only a small number of GAP practices were included in the baseline survey, a "Short GAP Index" was computed as well to compare baseline and midline results. This short GAP Index is based on the shorter list of GAP practices that were assessed in the baseline (see Table 2).

Table 37. GAP Index average values, compared to baseline and control group

Crop	Short GAP Index (comparison/baseline)				Complete GAP Index (comparison/control group)			
	N BL / MLt	Baseline	Midline Treatment	Stat. significant BL/MLt	N MLc / MLt	Midline Control	Midline Treatment	Stat. significant MLt/MLc
Mung beans	16/76	23%	27%	NS	41/72	49%	52%	NS
Shallot/ onions	20/64	25%	61%	*	32/58	51%	71%	*
Red rice	60/24	31%	53%	*	8/23	55%	56%	NS
Peanuts	60/555	14%	28%	*	36/54	30%	45%	*
All VCs	**156/219**	**23%**	**40%**	*****	**117/207**	**44%**	**56%**	*****

Results were overall very positive. Firstly, the GAP index significantly increased since the baseline: from 23% to 40% among all midline expansion farmers. Progression among shallot/onion producers was the highest (applied 25% of GAPs at baseline vs. 61% at midline), followed by red rice and peanuts.

This is well in line with known principles of adoption of new technologies by people, whereby there is usually 5% of early adopters, then 25% of early followers; the rest consisting of 40% of late adopters, 25% of very late/reluctant adopters, and 5% of non-adopters.

Secondly, comparison with the control group confirms that this progression is mostly happening among TOMAK's beneficiaries: treatment farmers apply on average 56% of the GAPs recommended while control farmers apply only 44% of these practices.

The VCs for which TOMAK has had the most impact in terms of adoption of GAPs are shallot/ onion and peanuts, with about 15-20% more GAPs applied among treatment farmers compared to control farmers. For mung beans and red rice though, differences with the control group are marginal. Indeed, for red rice, a number of key practices are still rarely implemented: transplanting at younger age, terracing (to allow production in hilled terrains), and speeding up the harvesting and threshing process. As for mung beans, the following key GAP practices are also still rarely implemented: ploughing, terracing, using organic pesticide, intercropping and threshing with a thresher.

Further analysis was conducted to look at midline expansion farmers only and compare different categories of beneficiaries (e.g. by municipality, gender, wealth index terciles, etc.). Possible correlations were all statistically tested yet the only significant difference appears to be between men and women: men applied more GAPs than women (58% vs. 53% among women). Interestingly,

wealthier farmers also applied more GAPs than poorer farmers: 59% among the wealthiest vs. 54% among the poorest. While this difference was not statistically significant, these results could reveal a trend where poorer farmers are less able to access some of the inputs recommended for GAPs. Surprisingly, the fact that farmers were visited by an AEW (at home or during FFSs/FFDs) did not impact strongly on how much they complied with the GAPs.

3. Sources of inputs needed to apply GAPs

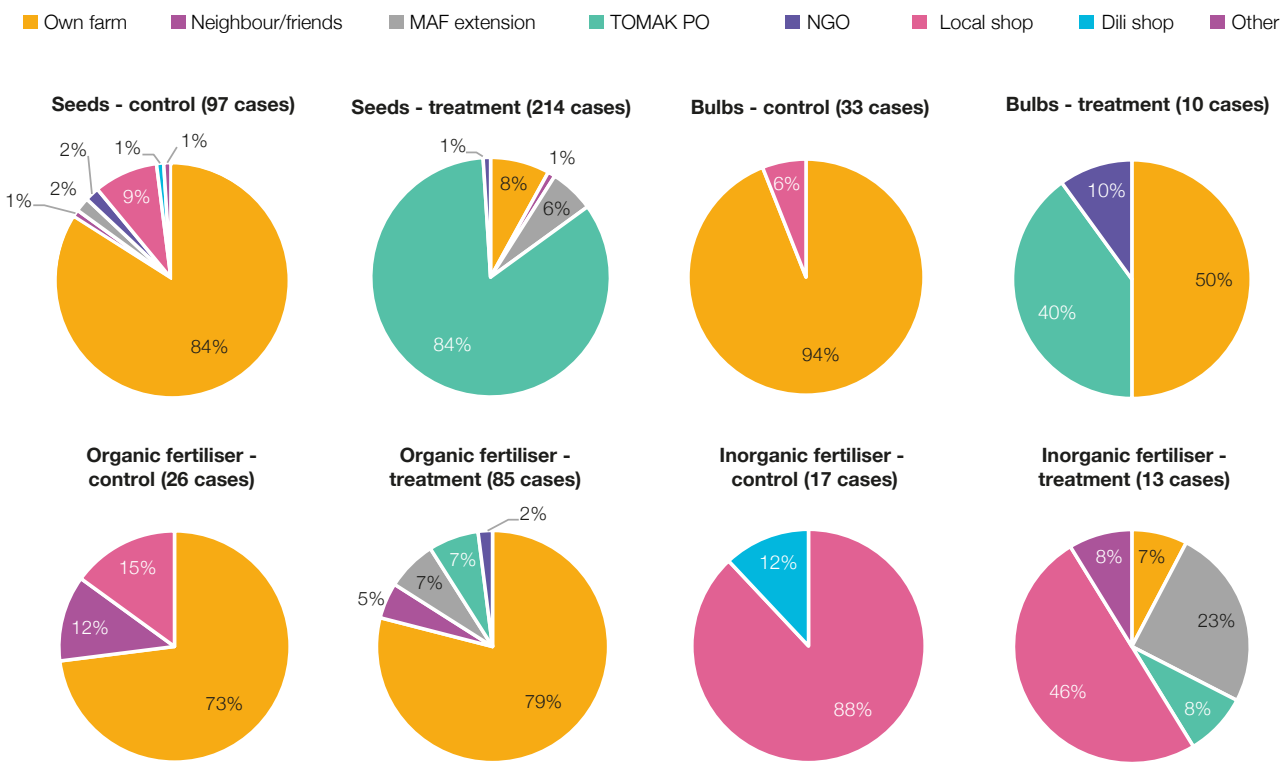
Farmers who applied GAPs that require specific inputs were then asked where they sourced these inputs from. The following charts present the sources of these inputs by control and treatment farmers.

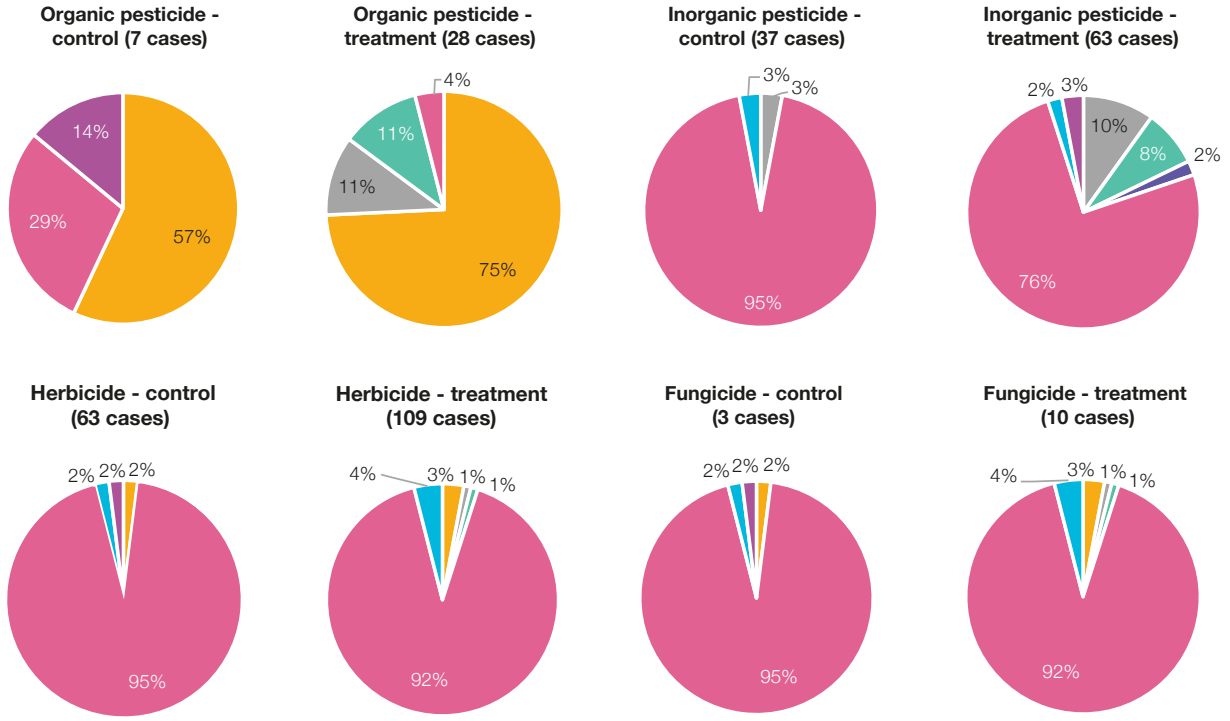
For seeds, bulbs and inorganic fertilisers, the sources differ significantly between control and treatment farmers:

- Most treatment farmers received improved seeds from TOMAK (subsidised improved varieties), while control farmers mainly used seeds/bulbs from their previous harvest. Note that TOMAK does not provide bulbs so farmers declaring bulbs came from the program were mistaken.
- Chemical fertiliser was also distributed to some treatment farmers by AEWs (23%) and TOMAK (one case) while 88% of control farmers bought these from local shops. It is possible that the farmer who declared receiving fertiliser from TOMAK was a demplot farmer in the past as no fertilisers are distributed to expansion farmers.

Interestingly, 75% of expansion farmers produce their own organic pesticide vs. 57% among control farmers. Very little support was provided for chemical pesticide, herbicide and fungicide. These were mostly purchased from local shops by both control and treatment farmers.

Figure 8. Sources of inputs needed to apply GAP, compared to control group



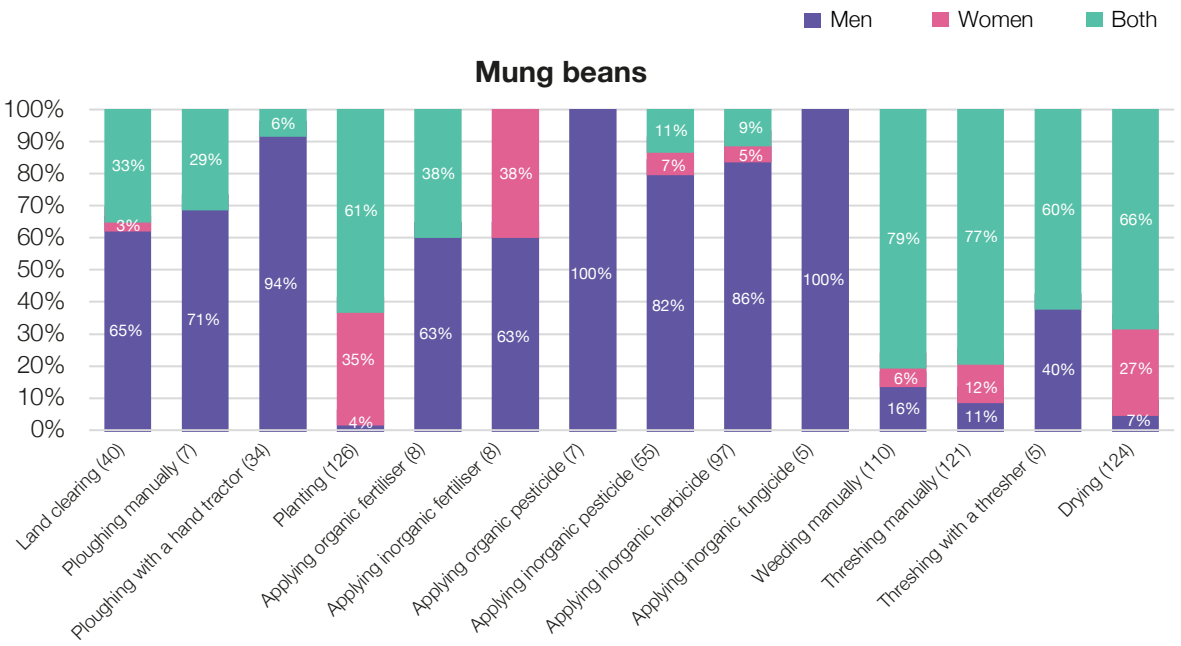


The very small proportion of farmers sourcing improved seeds from local shops is a concern as most farmers must then rely on programs such as TOMAK or NGOs to access improved varieties. Some of the more entrepreneurial expansion farmers and local seed production groups are now able to produce quality seeds. Yet this is still insufficient in the long run as new pure seeds need to be injected in the system to keep the quality levels high. Further work to strengthen the capacity of local shops to sell and source improved variety planting material would strongly benefit local farmers.

4. Gender division of labour

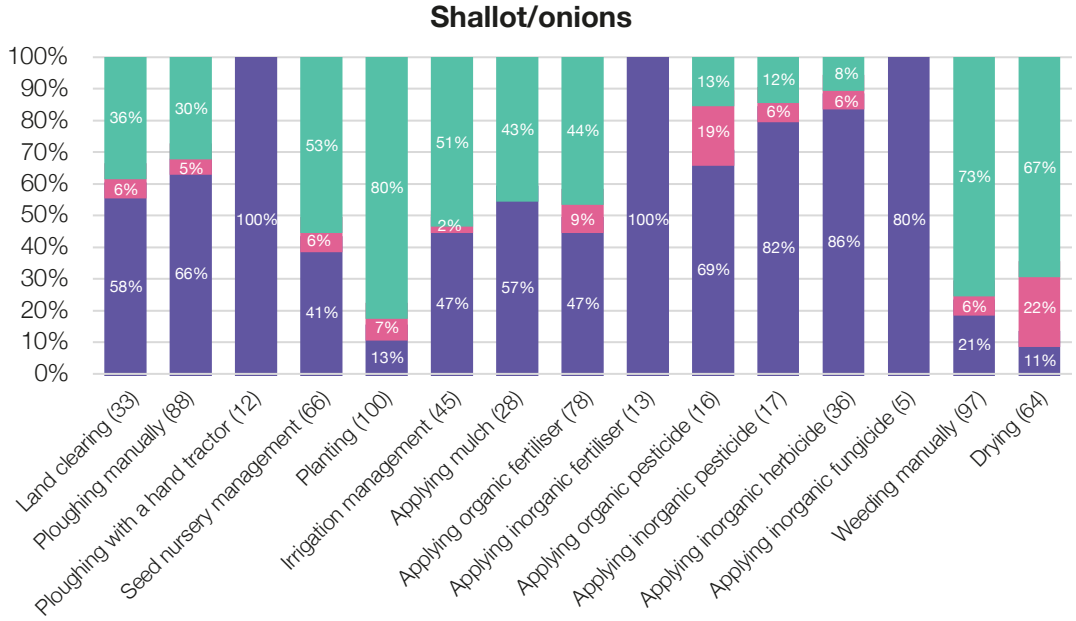
Respondents were then asked who usually performs each of the agricultural practices mentioned above: men, women or both. As questions related specifically to the production of the four VC crops, results are presented per VC in four different charts (see Figure 9).

Figure 9. Agricultural practices by gender and VC



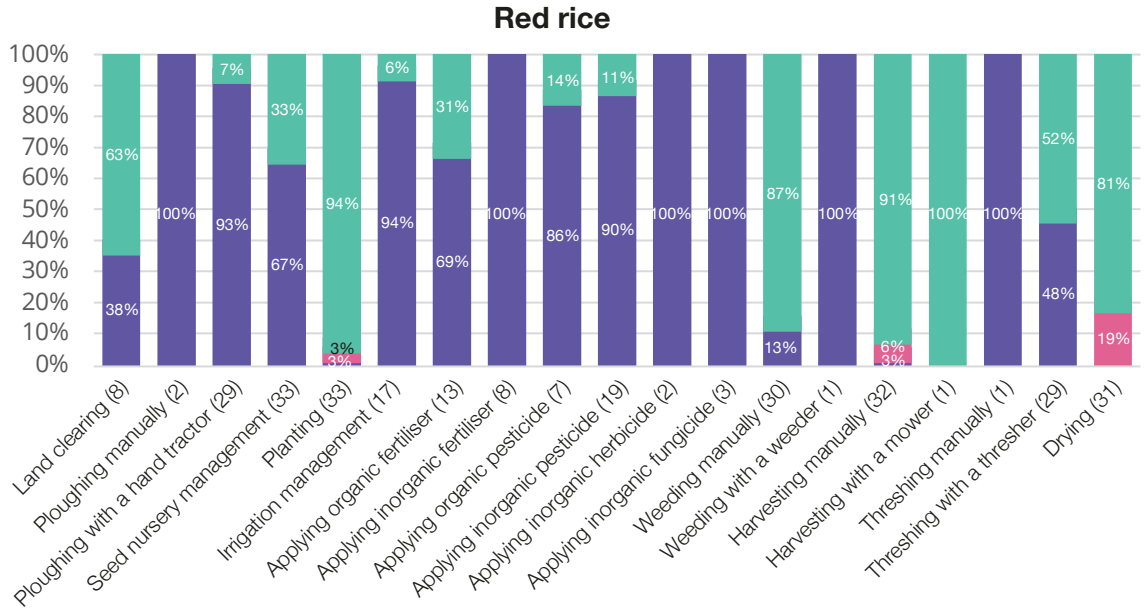
Main observations:

- Mung bean was the crop that involves the most women, even though there are few tasks that women do alone.
- Men are mainly in charge of land preparation and applying pesticides/fungicides/ herbicides.
- Women were more involved in planting and drying.
- Tasks that were mostly performed together include manual weeding, manual threshing and drying.



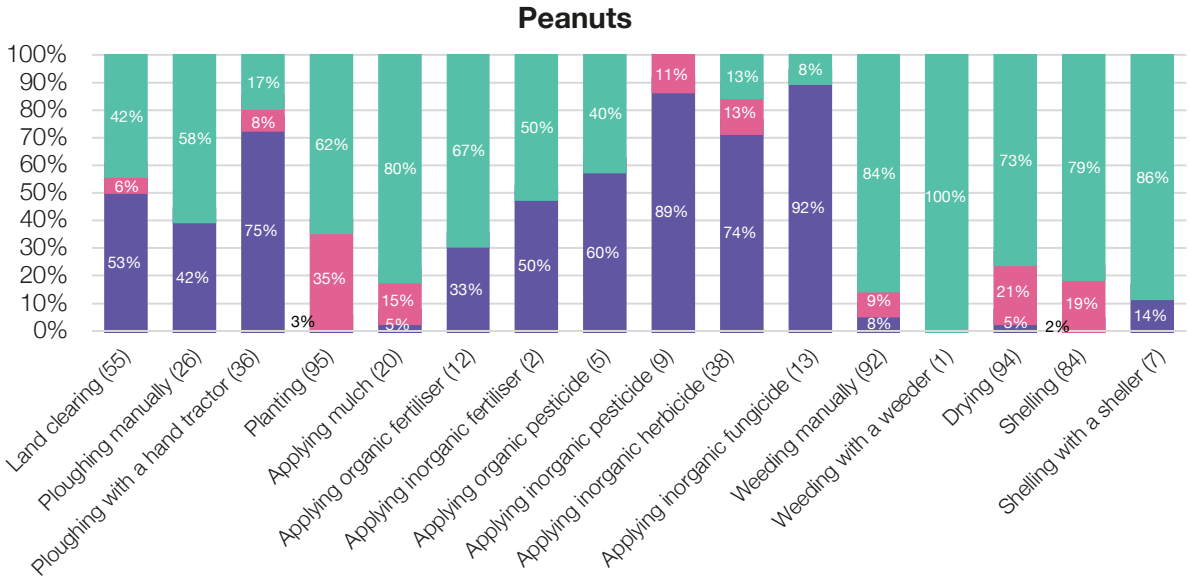
Main observations:

- Women's involvement alone was very limited. Activities in which women were sometimes involved were drying and applying organic pesticides.
- Most activities were performed by men alone or together (planting, manual weeding, drying).



Main observations:

- Red rice was clearly a men dominated crop.
- In a small proportion of cases (19%), it was women alone who dried the harvest.
- Some activities which require a lot of labour were done together: planting, manual weeding and manual harvesting, drying.
- Women's workload could be reduced by using mowers or weeders. Yet, only one farmer reported having used both a mower and a weeder.



Main observations:

- After mung beans, peanut was the other crop involving the most women, even though there were more activities that men did alone.
- As for other crops, activities where women were more often working alone included planting and drying.
- Women's workload could be reduced by using shellers or weeders. Yet, only 8% of peanut farmers had used a sheller and one used a weeder.

Comparison with baseline data could only be done for mung beans and shallot/onions for a number of activities. In the red rice and peanut baseline, the data collected did not specify the gender of the main persons in charge of each task. No statistical significant differences were observed except for land preparation and planting:

- Land preparation was more often performed by men and women together at baseline: 67% vs. 21% in the midline. Instead at midline, more men alone were reported to do land preparation.
- Planting was also more often performed by men and women together at baseline: 89% vs. 70% at midline. Instead at midline, more women alone were reported to do planting.

Further analysis was performed to see if men and women respondents had the same perception of how agricultural labour is shared. Interpretation of most statistical tests is limited because of the limited number of men and women interviewed for each VC. However, the overall trend was for women respondents to more often report that they are in charge of specific tasks such as managing the nursery, applying fertilisers/pesticides/herbicides, weeding, threshing or drying. This probably reflects some bias in how men tended to respond to these questions, sometimes not mentioning that women were involved in most tasks as well.

Further support could be provided to reduce women's workload by increasing access to peanut shellers, weeders and rice mowers for example. Only very few farmers had access to these machines. One instance was a wealthier woman farmer from Viqueque (Bahalaraua'in) growing red rice, who had used a rice mower and a weeder.

Note that during rice harvests which are done manually, women also often spend time cooking for the labourers across several days. Thus, increasing access to rice mowers would likely also reduce women's workload in the kitchen.

Additional analysis shows that for peanut especially (and to a lesser extent for shallot/onion growers too), wealthier farmers more often used machines (for either ploughing, shelling or weeding) than poorer farmers: wealthier peanut farmers used on average 0.75 machines vs. 0.21 for poorer farmers[25] and wealthier shallot/onion farmers used on average 0.26 machines vs. 0.06 for poorer farmers. Ensuring these tools are affordable to poorer households could be an interesting focus for future interventions.

3.3.5. Constraints during production and post-harvest

Farmers were asked what constraints they faced during production and post-harvest for their VC crops. At midline, similar questions were asked to red rice and peanut producers. For mung beans and shallot/onions, questions on constraints did not refer specifically to the VC crops but to all the crops grown on the farm. Thus, no comparison with baseline data could be made for those two crops.

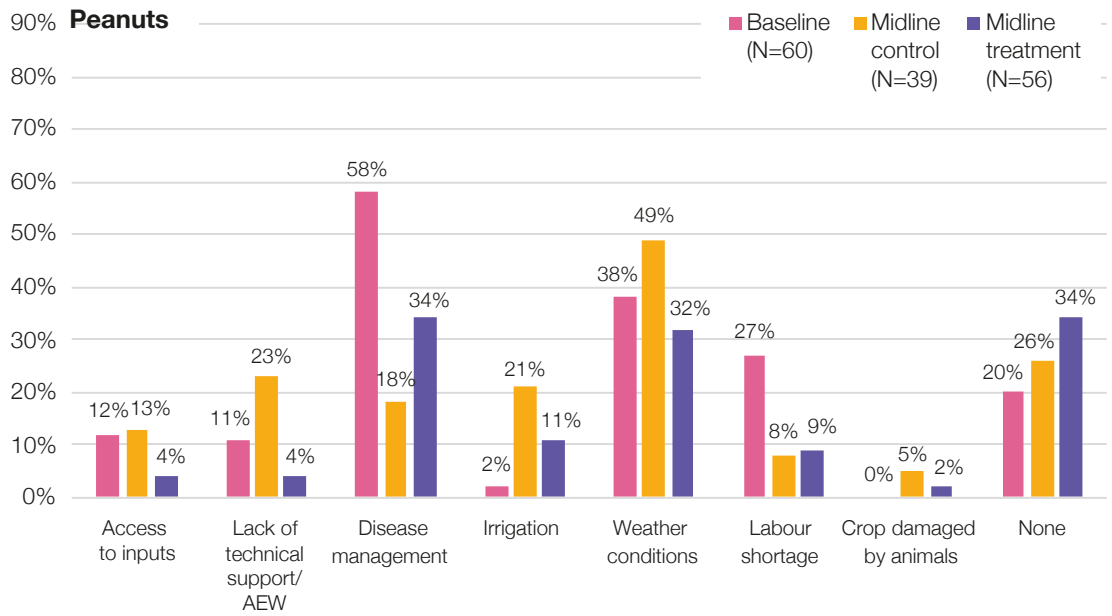
Constraints related to production

Figure 10 presents data on constraints related to production by VC. These results are first discussed in general and then the constraint "access to inputs", which is listed as an intermediate outcome in TOMAK's MELP, is specifically analysed.

[25] One-way Anova done on the total number of machines used by farmers (hand tractor/thresher/sheller/weeder).

Figure 10. Production constraints by VC, compared to baseline and control group[26]

[26] Statistically significant BL/MLt: ** disease management, irrigation, weather conditions, labour shortage, none (red rice), disease management, labour shortage (peanut). Statistically significant MLt/MLc: ** labour shortage, *** lack of technical support from AEW (mung beans); ** lack of technical support from AEW, irrigation (shallot/onions; *** lack of technical support from AEW (red rice); ** lack of technical support from AEW (peanuts).



The first thing to note is that the proportion of farmers who reported "no constraints" increased from the baseline for peanut and red rice VCs (close to 20% higher) and was also higher than among control farmers (close to 10% higher). TOMAK's intervention has helped a significant proportion of red rice and peanut farmers (at least 10%) to improve their practices and overcome some of the common constraints they previously faced.

For all crops (besides red rice), disease management and weather conditions remain the most commonly stated constraints (from one-third to half of the sampled treatment farmers). In fact, significantly fewer mung bean and peanut treatment farmers listed "disease management" as a constraint compared to the baseline. Yet for all crops, this proportion is higher among treatment farmers than among control farmers (although this difference was not significant). This could reflect the fact that expansion farmers have become more aware and concerned about disease management than control farmers.

Note that more women expansion farmers reported struggling with disease management: 44% vs. 29% of men expansion farmers.[27] Further assistance to women in this regard is needed, especially for mung beans and peanuts.

Weather conditions were also an important constraint for producers. As stated previously in this report, 2020 was marked by an important drought from January to March followed by heavy rains in April which often damaged shallot/onion nurseries. As a result, rice production was strongly affected; this resulted in fewer red rice producers being identified for this survey. However, irrigation has still significantly improved since the baseline: 55% listed irrigation as a constraint at the baseline vs. 29% at midline.

Overall, weather conditions was reported more frequently a constraint among treatment farmers with light disability than among farmers with no disability (41% vs. 22% among people with no disability). This is especially true for mung bean producers (50% vs. 12% among people with no disability). The "light" disability" of these persons is mostly related to walking, which could indeed have an impact on how easily they are accessing their plots, especially during heavy rains for example.

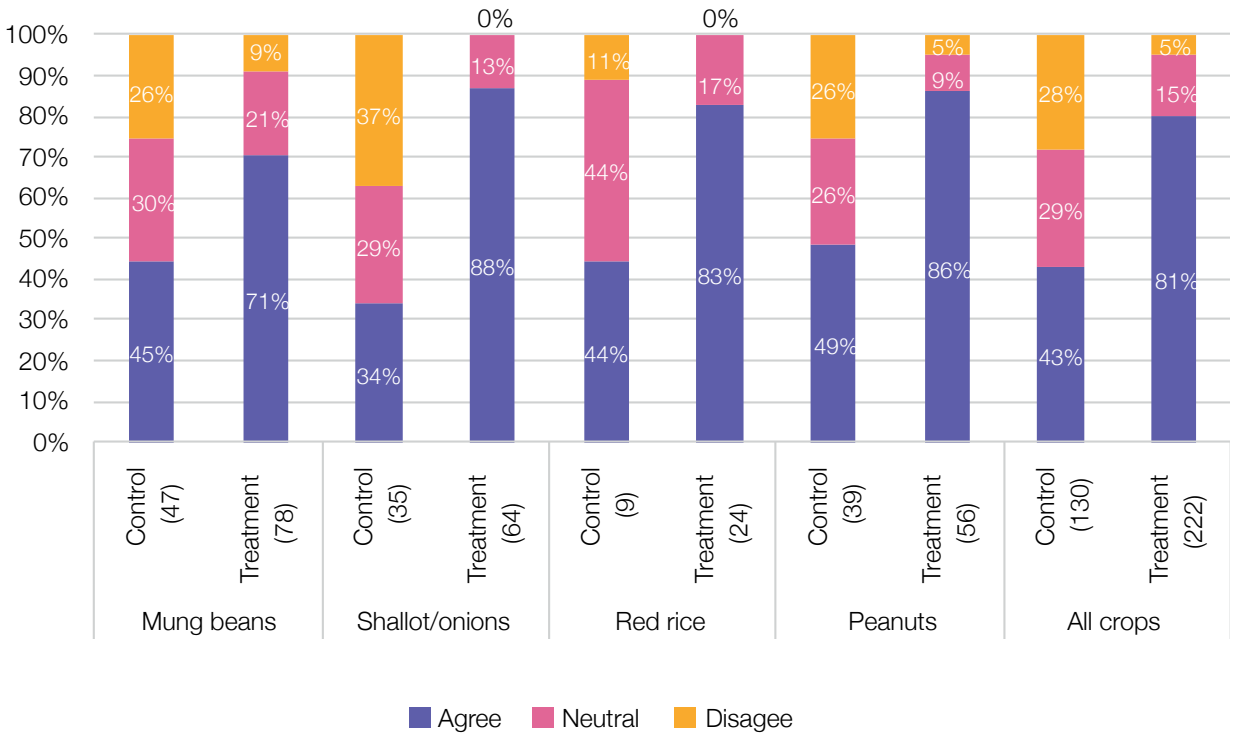
[27] Chi-square test: $p<0.05$.

Lastly, it is very clear that lack of technical support from AEWs was no longer an issue for most expansion farmers (AEWs were met regularly during FFSs) while it was a constraint for about 10% of baseline red rice and peanut farmers, and was raised by about 20% of control farmers in the midline survey.

Accessing required production inputs

In addition to the above data, the midline study also included a question specific about access to inputs: "To what extent do you agree with the following statement: I feel confident that I can reliably access production inputs, such as fertiliser and farm equipment". Possible answers ranged from "strongly disagree" to "strongly agree" (Likert-scale question).

Figure 11. Farmers' perception on how reliably they can access inputs



For mung beans, shallot/onions and peanuts, statistical tests showed an association with the respondents from the treatment or control group: treatment farmers more often agree that they can reliably access input compared to control farmers[28] (up to 26% more for mung bean and 54% more for shallot/onion). This is understandable because many of the expansion farmers interviewed were in their first year of involvement with the program, and thus had access to subsidised seeds from TOMAK (50% subsidies provided during the first year).

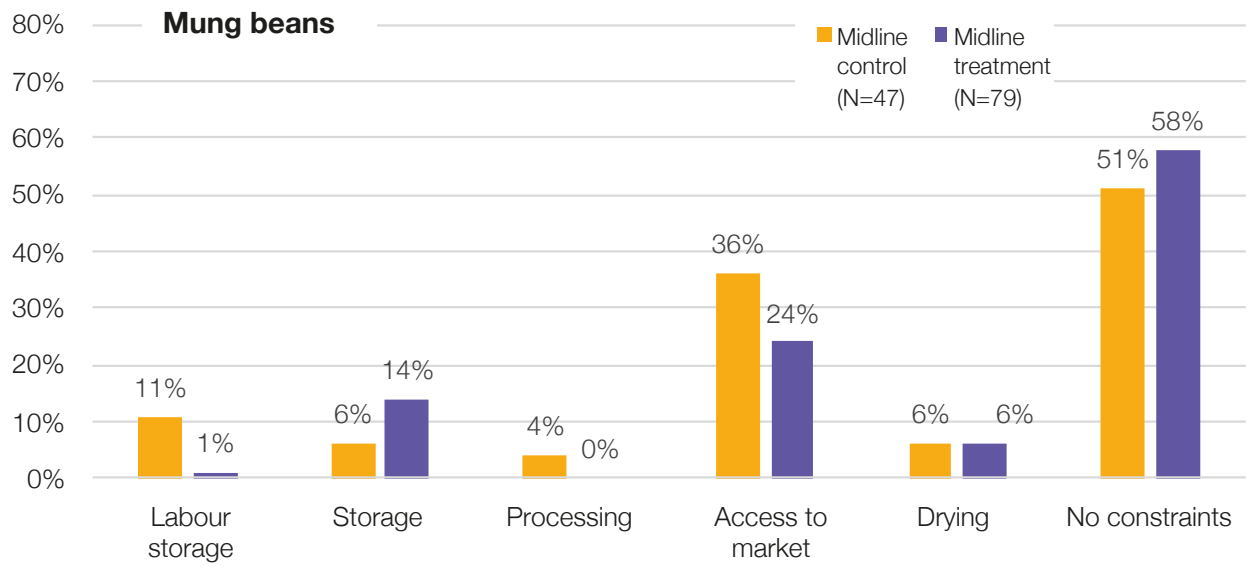
Note that there was no significant difference between the overall proportion of men and women who reported that they can reliably access inputs. Only slightly more men said they "strongly agree" with the above statement compared to women: 60% vs. 47% of women.

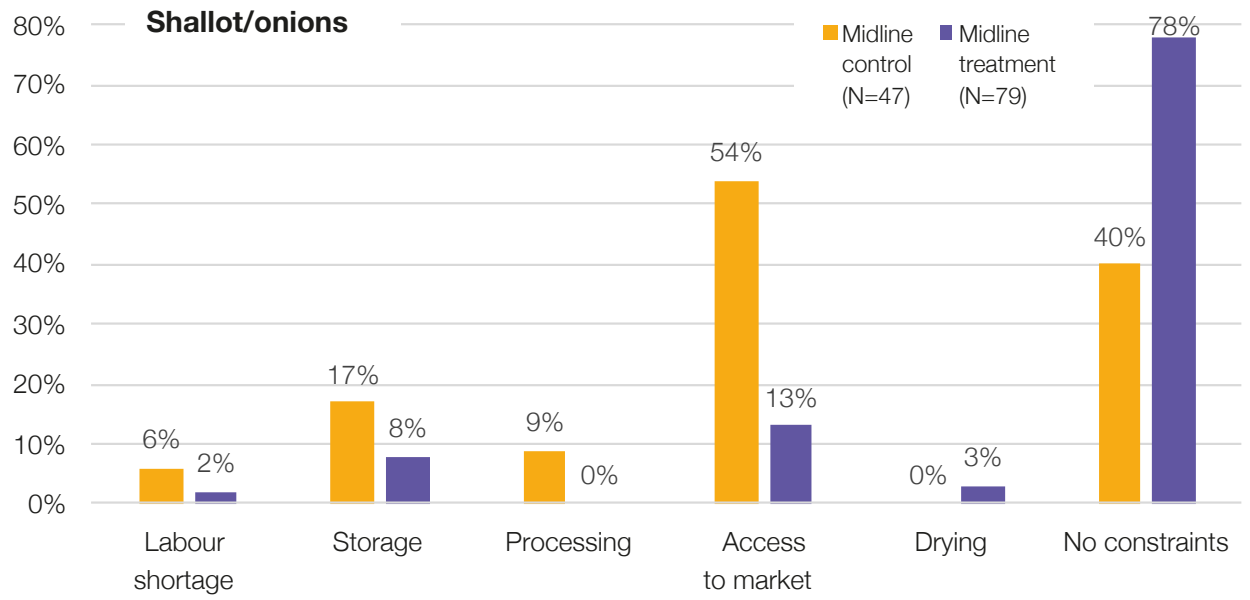
[28] For red rice, the number of control farmers was too small to validate the statistical test result.

Constraints related to post-harvest

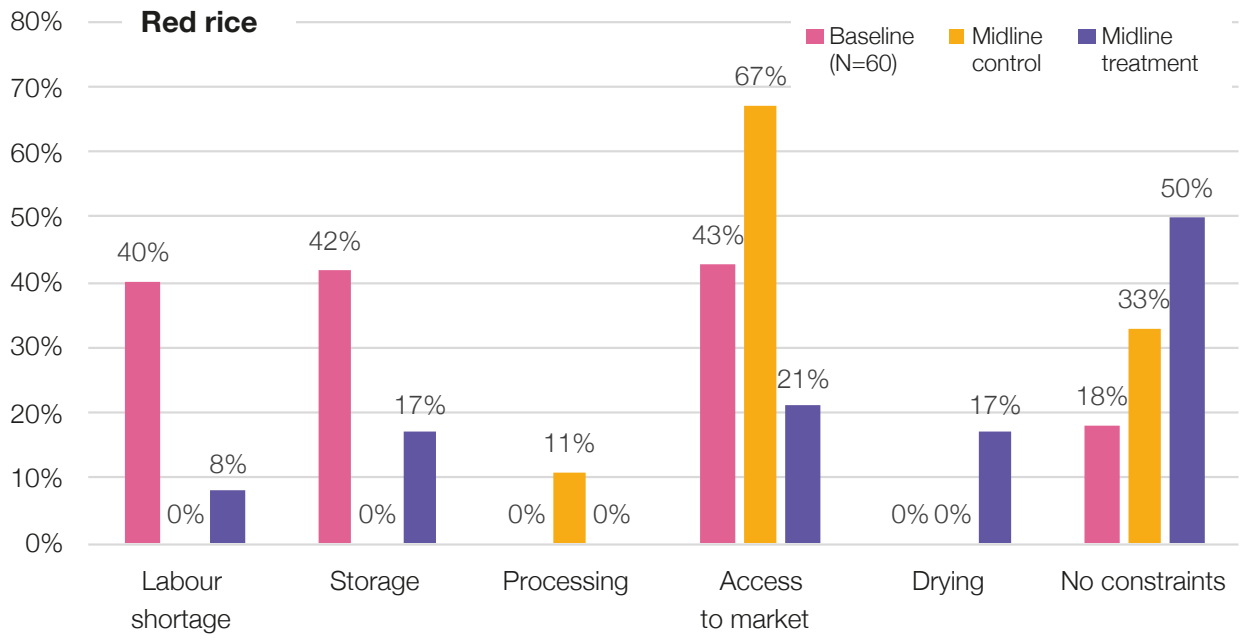
Figure 12 summarises data on post-harvest constraints.

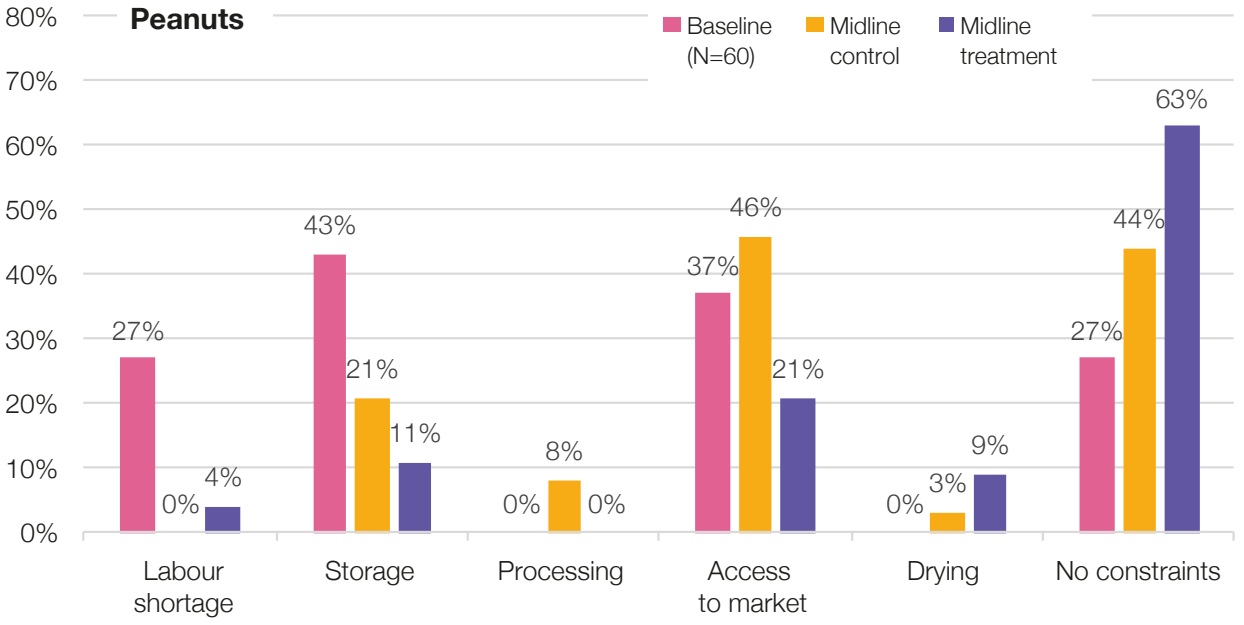
Figure 12. Post-harvest constraints by VC, compared to baseline and control group[29]





[29] Statistically significant BL/MLt: ** labour shortage, storage, no constraint (red rice and peanuts). Statistically significant MLt/MLc: ** no constraint, *** access to market (shallot/onions); *** access to market (red rice); ** access to market (peanuts).





More than half of the expansion farmers did not report any post-harvest constraints (up to 78% for shallot/onions).

Access to market was the most frequently stated constraint for all VCs, but was mentioned significantly less by treatment farmers: about 20% of treatment farmers vs. 50% of control farmers. TOMAK's efforts linking expansion farmers to markets appears to have paid off although further work is still needed, especially in Cailaco and Balibo (Bobonaro). In these two administrative posts, between 30% and 35% of the expansion farmers mentioned having difficulties in finding a market (these are mainly mung bean and peanut farmers as well as few shallot/onion producers).

Note also that in March and April 2020, local marketplaces across the country were closed as part of the Government's preventive measures against the COVID-19 pandemic. This would have impacted

market access for mung bean and peanut farmers of Bobonaro and Baucau who harvested close to that period of the year.

Storage was the second most frequently stated constraint but this was reported by less than 15% of expansion farmers. For red rice and peanuts, this proportion had decreased very significantly since the baseline (about 40% less), probably due to the use of Grain-Pro bags which were popular among these farmers. Indeed, 42% of red rice expansion farmers and 29% of peanut expansion farmers purchased Grain-Pro bags vs. 12% of mung bean and shallot/onion producers.

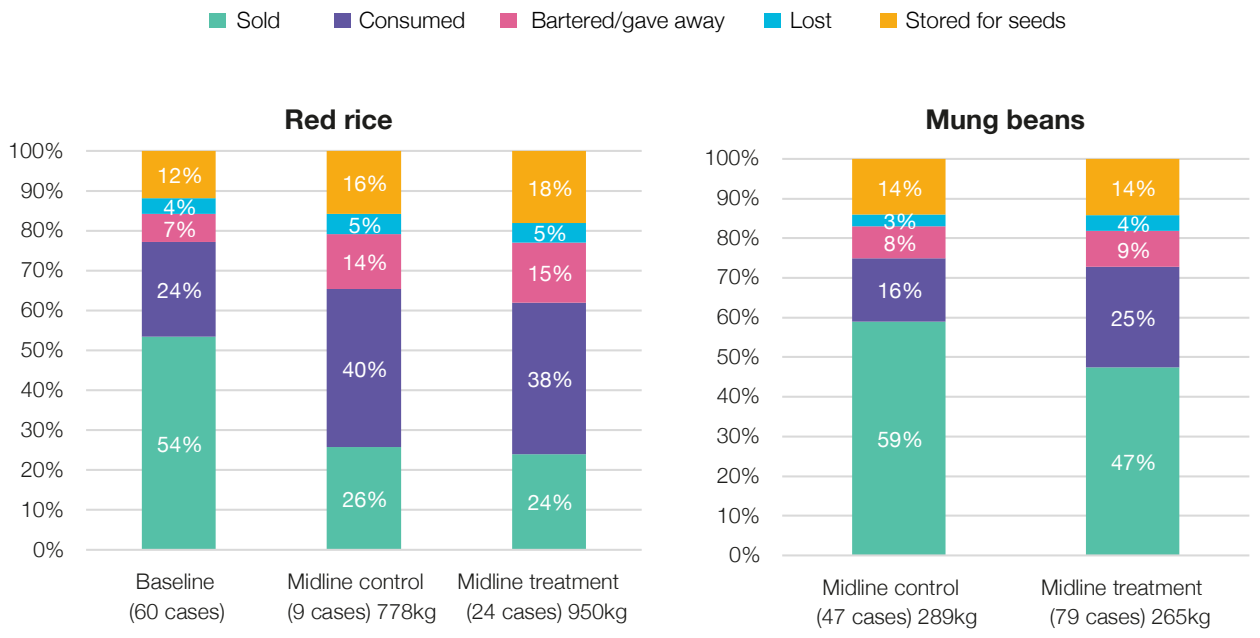
Drying remains a problem mainly for red rice producers (17% of expansion farmers). Stressing the importance to speed up the harvest and threshing phases before drying to allow a uniform drying of grains could help improve this situation.

3.3.6. Use of harvests

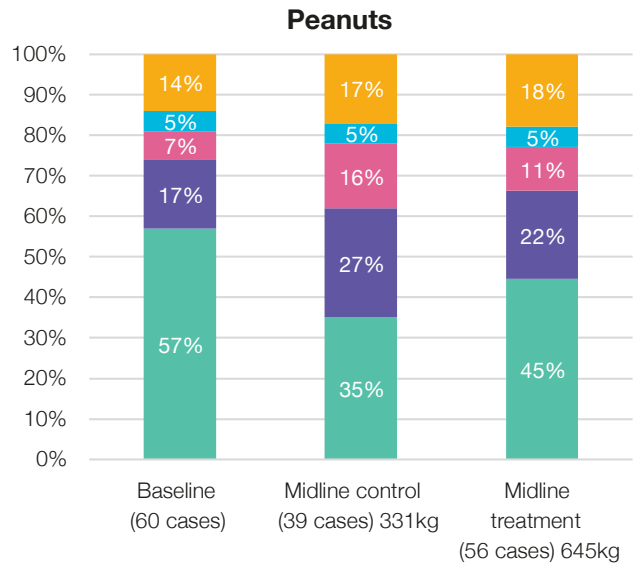
Proportion of harvests that are consumed, sold, given, lost or stored

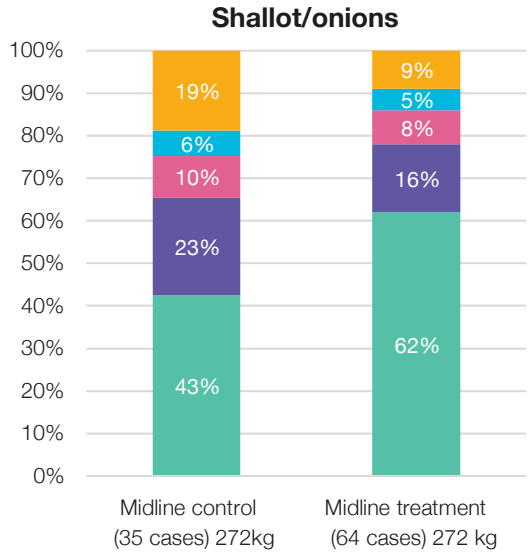
Respondents were asked approximately what share of their production they had sold/consumed/bartered or gave away/stored for seeds/lost. Similar information was collected during the red rice/peanut baseline survey but not during the mung bean/shallot/onion baseline survey.[30] For mung beans and shallot/onions, the proportion of the harvest that was sold could however be calculated using information provided on the volumes produced and sold.

Figure 13. Various uses of the harvest compared to baseline and control group[31]



[30] The question did not target VC crops only but all crops produced.
[31] Total kilograms harvested are indicated for the midline treatment and control groups under each bar.





For all VC crops (besides red rice at midline stage), the first use of the harvests was for selling. The proportion of the harvest that was sold had reduced since the baseline for all crops (including mung beans and shallot/onions which are not shown in the charts[32]). The decrease was more significant for red rice (54% at baseline to 24% at midline). It is unclear whether this was an effect of the questioning method or because farmers have actually changed their selling practices or both. Due to limited baseline data on volumes produced,[33] it was not possible to correlate this with an increase or decrease in the volumes produced. On the other hand, proportions consumed or bartered had increased since the baseline, which may also benefit the HH economy as a whole (less food purchased).

Peanuts and shallot/onions expansion farmers sold higher proportions of their harvest than the control group, suggesting higher volumes were produced by TOMAK beneficiaries for those two crops (confirmed for peanuts in Table 25: 645kg produced among treatment farmers vs. 331kg among control farmers). Instead, mung bean expansion farmers sold smaller proportions than the control group (47% vs. 59%) which reflects the lower volumes produced (Table 25: 265kg produced among treatment farmers vs. 289kg among control farmers).[34]

Post-harvest loss

Table 38 summarises data on post-harvest loss as this is part of indicator 35 of TOMAK's MELF.

Table 38. Proportion of post-harvest loss, compared to baseline and control group

Crop	N BL / MLc / MLt	Baseline	Midline		Stat. significant BL/MLt	Stat. significant MLt/MLc
			Control	Treatment		
Mung beans	-/47/79	N/A	2.7%	4%	NS	NS
Shallot/onion	-/35/64	N/A	5.7%	5.2%	NS	NS
Red rice	60/9/24	4.4%	4.4%	4.6%	NS	NS
Peanuts	60/39/56	4.9%	4.6%	5.2%	NS	NS

[32] At baseline, the average proportion of mung beans that was sold was 68% and for shallot/onions: 75%.
[33] No data collected on volumes of red rice and peanut produced and limited number of cases for mung beans and shallot/onions (9 and 13 cases respectively with information available on volumes produced and proportion sold).
[34] All significant differences noted here related to the use of harvests were statistically significant (Independent Sample T-test: P<0.05).

Post-harvest losses were very similar to what they were at the baseline stage. Differences between control and treatment farmers were also not statistically significant. This is not surprising as 4-5% at baseline was already quite low and differences might be difficult to observe if post-harvest loss data was collected by asking farmers to estimate the overall proportions lost.

Assessing the storage practices of farmers could provide further indications of whether post-harvest losses may have reduced or not. No information was collected on farmers' storage practices during the baseline so comparison can only be made between control and treatment farmers:

- The number of days shallot/onion and peanut expansion farmers dried their harvests was on average longer than what control farmers reported: 3.4 days vs. 2.8 days for control shallot/onion farmers and 6 days vs. 5 days for control peanut farmers.
- 25% of peanut expansion farmers (13 cases) stored their harvest into air-tight Grain-Pro bags and 11 among them put the bags into drums or on pallets, preventing rodents from reaching the bags.
- Among peanut farmers who stored their harvests in other sacks (did not have Grain-Pro bags), more treatment farmers decided to put these sacks into drums or on pellets: 48% vs. 32% among control farmers.
- Higher proportions of treatment farmers stored mung beans in safe containers such as silos, Grain-Pro bags, bottles or jerry cans (40%) while most control farmers used rice, sugar or coffee sacks which can easily be infested by pests as they are not air-tight. Only 17% of control farmers used safe storage practices (mostly jerry cans).
- 42% of the red rice expansion farmers reported having received Grain-Pro bags which could have reduced post-harvest losses significantly.
- For shallot/onions, there are no major concern for losses by pests or rodents. Yet, about 17% of both control and treatment farmers still like to store their harvest loose on the floor or on the ground which can damage shallot/onions because of dirt and humidity.

From the above data, it seems clear that expansion farmers have adopted safer and better drying and storage practices, which in turn, are likely to reduce the proportion of post-harvest losses.

3.4. Sale of value chain crops

3.4.1. Volumes sold per farm

Based on the proportion of total harvested volumes that were sold, the average quantities sold per farm could be calculated. Note that in the mung bean and shallot/onion baseline, farmers were asked how many units were sold. These units were then converted into kilograms.

Table 39. Average volumes sold per farm, compared to baseline and control group

Crop	N BL / MLc / MLt	Baseline	Midline		Stat. significant BL/MLt	Stat. significant MLt/MLc
			Control	Treatment		
Mung beans	9/46/76	167kg	163kg	155kg	NS	NS
Shallot/onions	13/26/48	199kg	124kg	171kg	NS	NS
Red rice	-/9/22	N/A	196kg	282kg	NS	NS
Peanuts	-/39/54	N/A	132kg	316kg	NS	*

When compared to the baseline, volumes of mung beans and shallot/onions sold appear to have decreased. But the baseline samples were very limited and thus, there is no certainty that this is

correct. Therefore, comparison with the control group seems more reliable.

More interesting is the comparison with the control group: expansion farmers were selling larger volumes than the control group, except for mung beans for which the difference was marginal (8kg). Expansion farmers have indeed become more commercially oriented based on the data of increased average volumes sold. However, caution is needed to compare this for onion/shallot farmers where, as noted in Table 24; the profit per kg is higher in the control group.

3.4.2. Income generated per farm from the sale of VC crops

Respondents were then asked what price they could commonly sell their harvests, as well as the minimum and maximum price they had received in the past (Table 40). Unfortunately, at midline, 229 farmers were not able to remember this information and at baseline the question was only asked for mung beans and shallot/onions.

For mung bean sales, TOMAK's research data showed slightly higher prices (1.5USD/kg) than what farmers mentioned in the survey. While for red rice and peanuts, TOMAK's data was lower than the prices reported by farmers (0.5USD/kg and 1.2USD/kg for red rice and peanut respectively).

Table 40. Reported price of VC crops at baseline and midline (USD/kg)

Crop	Baseline		Midline	
	N	Common price	N	Common price
Mung beans	15	1.1	45	1.1 (min: 0.9 / max: 1.2)
Shallot/onions	19	1.6	43	1.5 (min: 1.3 / max: 1.5)
Red rice	-	N/A	6	1.0 (min: 0.8 / max: 1.1)
Peanuts	-	N/A	30	1.5 (min: 1.2 / max: 1.6)

Based on these prices, the income generated from crop sales was calculated (Table 41). However, as many farmers were not able to remember the price they sold their harvest, the size of the sample in Table 41 is fairly small (much smaller than in Table 39) and most likely, not representative.

Table 41. Average income[35] generated from sale of crops per farm[36]

Crop	Control				Treatment				Stat. signif. (income)
	N	Volume sold (kg)	Common price (USD)	Income generated (USD)	N	Volume sold (kg)	Common price (USD)	Income generated (USD)	
Mung beans	19	203	1.14	235	26	227	1.14	283	NS
Shallot/onions	3	166	0.92	152	30	242	1.53	372	NS
Red rice	1	330	1.00	330	5	405	1.04	380	NS
Peanuts	2	270	1.50	405	27	515	1.49	763	NS

Peanut producers were able to generate the highest incomes as volumes sold were quite large (see Table 41) and price was also among the highest of the four crops.

[35] Averages were calculated only among farmers selling their harvest. Note that values for the average income generated did not always match exactly the calculation "volume sold X common price" because data presented in the table are rounded averages of the price and volume sold.

[36] Please note that the number of farmer respondents in Table 41 is significantly different from the sample size in Table 39, resulting in different numbers for volumes sold.

Overall, income generated by treatment farmers was higher than among control farmers. Although not statistically significant, this was quite clear for mung bean producers. But for other crops, the fairly small sample sizes of control farmers prevents us from making reliable conclusions on these differences.

3.4.3. Buyers

A set of questions was asked to understand how expansion farmers are selling their harvests and assess the impact of TOMAK's facilitation work.

Firstly, respondents were asked if collectors came to buy products at their farm gate (Table 42). This was much more frequent among treatment farmers: 57% vs. 39% among control farmers. This difference was statistically significant suggesting TOMAK's efforts to link farmers with collectors has benefited close to 20% of the expansion farmers who most likely did not have collectors coming at their farm gate before the program intervention.

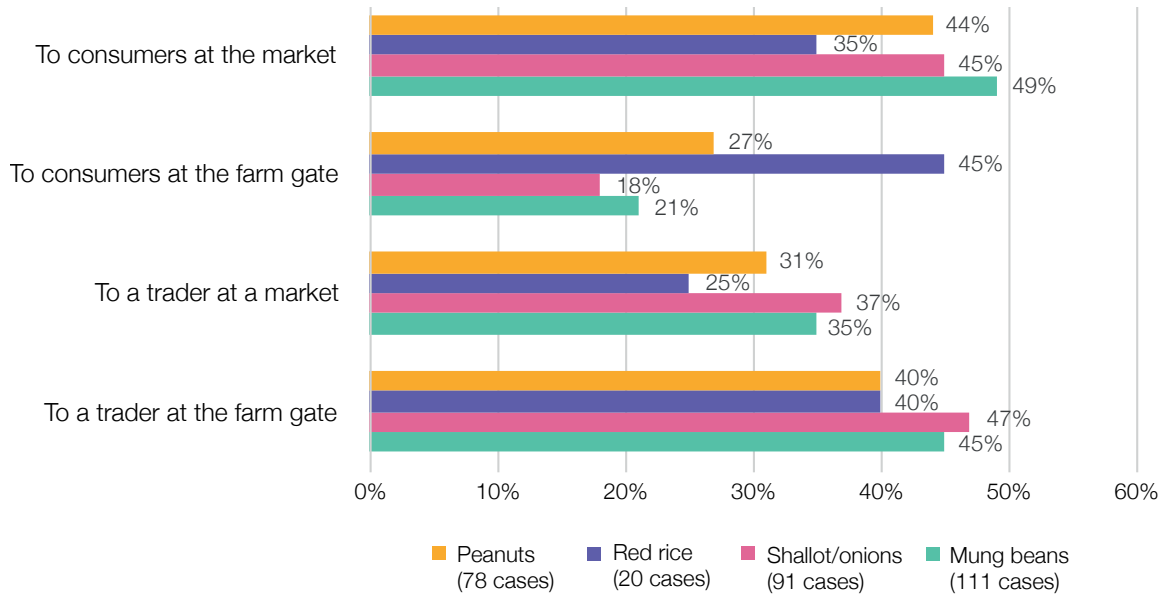
Table 42. Access to collectors at farm gate, compared to control group

	Control N=130	Treatment N=223
Yes, regularly	8%	13%
Yes, sometimes	31%	44%
No, never	62%	43%

Among expansion farmers, it appears that men were better linked to collectors than women: only 37% reported never meeting collectors at the farm gate vs. 57% among women expansion farmers.[37] Additional efforts to link women farmers to collectors may be needed to improve this situation.

Further details were then collected with regards to which buyers farmers sold their VC harvests to in the past 12 months (Figure 14).

Figure 14. Buyers of VC harvests during the past 12 months (multiple choice question)

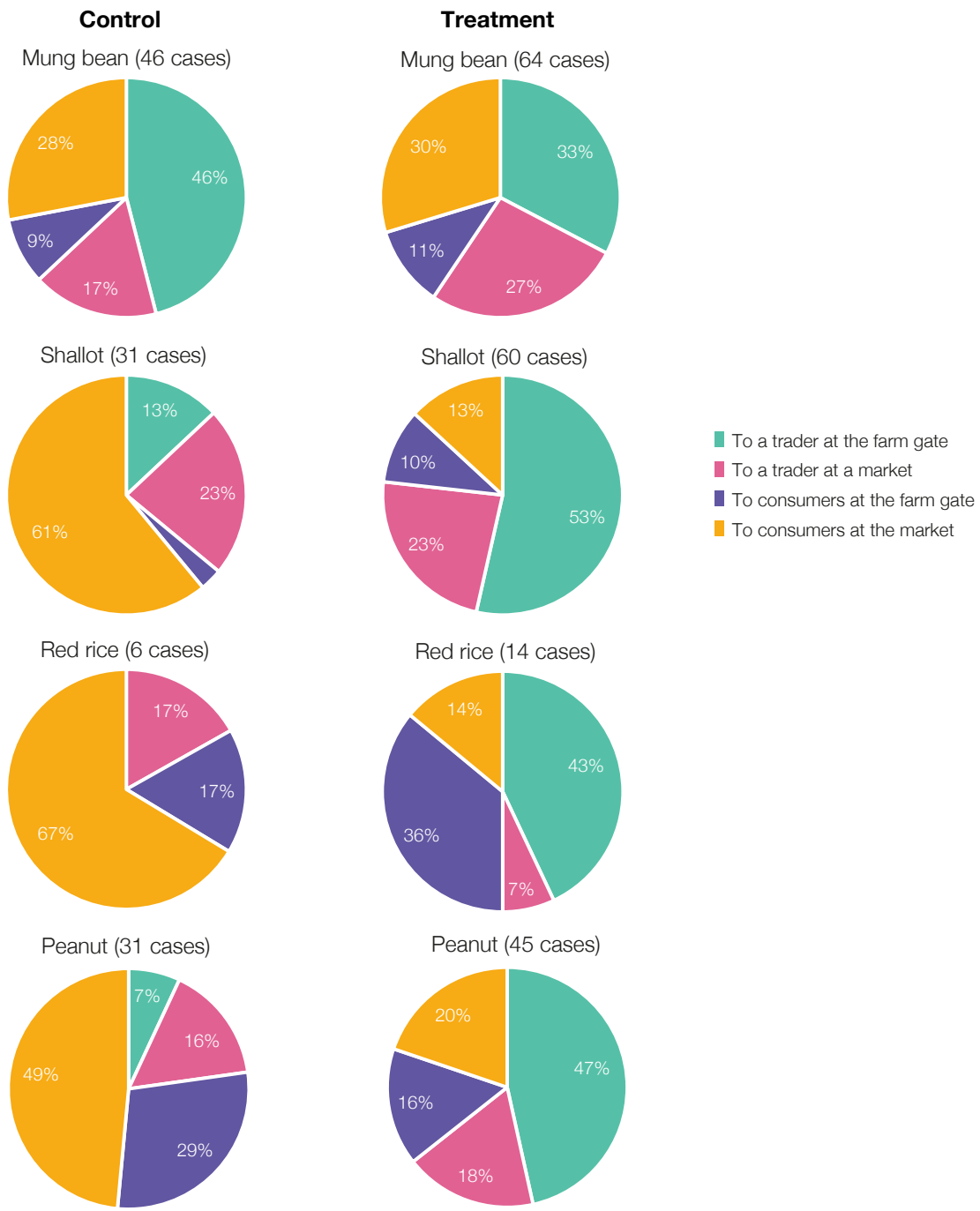


[37] Chi-square test: $p<0.05$.

The most common cases are selling to a trader at the farm gate and to consumers at the market. Selling to consumers at the farm gate varied a lot depending on crops: common for red rice but rare for shallot/onions and mung beans.[38] Note that local rice collectors come to buy farmers' harvest at the farm gate with trucks. Perhaps some farmers actually meant that they sold their rice harvest to these traders rather than to consumers coming to the farm.

Figure 15 presents the above data by control vs. treatment farmers.

Figure 15. Main way of selling VC harvests during the past 12 months, compared to control group



[38] Independent sample T-test: $p<0.05$.

Interestingly, for shallot/onions, peanuts and red rice, selling to traders at the farm gate was more frequent among treatment farmers, and statistically significant for shallot/onions and peanuts. TOMAK has put a lot of effort into finding a market for expansion farmers and facilitating linkages with traders. In fact, some expansion farmers have become collectors themselves. Control farmers on the other hand mostly sell to consumers at the market (which is more time consuming and less productive).

For mung beans, the situation was quite different: less treatment farmers sold their harvests at the farm gate compared to control farmers (33% vs 46% in the control group) and more sold their harvest to traders at the market (27% vs. 17% in the control group). Further exploration of the data suggests that this could be linked to farmers' wealth. Indeed, treatment mung bean farmers appear to be significantly poorer than control treatment farmers (39% in the first tercile vs. 9% among control mung bean farmers). Poorer farmers may be more inclined to sell their harvests at local marketplaces due to the slightly higher prices offered compared to selling their crop at the farm gate.

Proportion of TOMAK farmers confident that they are able to reliably access collectors

In order to respond to this indicator, farmers were asked to what extent they agreed with the following statement: "I feel confident that I can reliably access collectors and other large buyers". The results show that expansion farmers were generally much more confident than control farmers:[39] 63% are very confident vs. 36% among control farmers.

When looking at treatment farmers only, the proportion of farmers confident that they could access collectors was slightly higher among men: 81% vs 77% among women. This included a higher proportion of men who replied "strongly agree": 69% vs. 55% for women. This difference reinforces the need for further efforts to link women expansion farmers to collectors.

Table 43. Farmers' perception on how reliably they can access collectors compared to control group

	Control	Treatment
	N=130	N=223
Strongly agree	36%	63%
Somewhat agree	29%	16%
Neutral	29%	14%
Somewhat disagree	6%	5%
Strongly disagree	1%	2%

When looking at each VC farmer separately (Table 44), it appears red rice farmers were slightly less confident about accessing collectors than other VC farmers: 71% vs. 80% on average among other VC crops. For peanuts, the difference between control and treatment farmers was statistically significant, suggesting TOMAK's intervention has contributed to this change.

[39] Chi-Square test: $p<0.05$.

Table 44. Percentage of farmers confident they can access collectors compared to control group

Crop	Control		Treatment		Stat. significant
	N	Average	N	Average	
Mung beans	47	72%	79	81%	NS
Shallot/onions	35	69%	64	78%	NS
Red rice	9	44%	24	71%	NS
Peanuts	39	56%	56	82%	**
All	**130**	**65%**	**223**	**79%**	*

3.5. Extension services and other support to farmers

3.5.1. Agricultural extension workers

TOMAK has worked closely with MAF's extension department in order to improve services to farmers. To assess the result of this intervention, the midline survey included a set of questions on the support farmers receive from AEWs. Note that the baseline did not include such questions.

Visits from AEWs

As shown in Table 45, treatment farmers were often visited by AEWs, at their farm, during a FFS or FFD. The difference with control farmers is highly significant: less than 10% of control farmers were visited by AEW vs. more than 90% of treatment farmers.

Table 45. Contact and visits from AEWs during the past year

Support received	Control N=130	Treatment N=224	Stat. significant MLt/MLc
Knows how to contact local AEW	11%	82%	***
AEW visit at farmer's home/farm	8%	91%	***
Average number of times visited at farm	2.5	2.9	
AEW visit at the FFS	6%	96%	***
Average number of times visited at FFS	1.3	2.0	*
AEW visit at the FFD	4%	93%	***
Average number of times visited at FFD	1.2	1.9	*

A slightly higher proportion of the expansion farmers not being visited by AEWs were in Viqueque (suku Uma Uain Craic): 15% vs. 9% and 6% in Bobonaro and Baucau respectively.

Wealthier expansion farmers tend to be visited by AEWs more often than poorer farmers: 96% among the wealthier farmers (T3) vs. 87% of the poorest tercile. No statistical association was established but it is important to ensure that this trend does not continue in the future.

Type of support received from AEWs

Farmers who were visited by AEWs were further asked what support they received from AEWs (Table 46). Given only 13 control farmers were asked these questions, it is difficult to make meaningful comparisons between control and treatment groups here.

Table 46. Type of support received from AEW during the past year

Type of support received	Control N=13	Treatment N=218
Advice on pest and disease control	62%	81%
Distribution of agricultural inputs	46%	71%
Advice on good nutrition	31%	71%
Linkage with buyers	39%	66%
Linkage with input suppliers	31%	62%

Overall, expansion farmers received a wide variety of support from AEWs. Advice on pest and disease management was the most frequent (81%) while about 60-70% of expansion farmers were linked to buyers or input suppliers.

Upstream (access to inputs) and especially downstream linkages (access to the market) are important to sustain VC crop production. Farmers who were linked to buyers by AEWs less frequently listed "access to market" as a constraint: 14% vs. 36% among farmers who were not linked to buyers. Reinforcing AEW support in this regard will most likely encourage more farmers to produce.

Linkage to input suppliers or buyers is statistically associated to the gender of the expansion farmers: men receive more support than women in these regards (68% of men expansion farmers vs. 53% of women expansion farmers are linked to input suppliers and 72% of men vs. 59% of women are linked to buyers).

Differences were also found between AEW services in the different municipalities. Significantly more expansion farmers from Bobonaro received information on nutrition: 76% vs. 62% in Baucau and 56% in Viqueque. If has been observed by TOMAK that some AEWs are better skilled than others in certain topics, therefore exchanges and exposure trips might be worthwhile for some AEWs to learn from the skills and good experience of their colleagues from other municipalities.

Lastly, expansion farmers with light disability more frequently reported receiving inputs from AEWs: 85% vs. 65% among expansion farmers with no disability[40].

NSA promotion by AEWs

The same group of respondents were also asked if their AEW had discussed a number of nutritional topics with them. Each topic was read out loud to farmers which explains why more respondents here report that AEWs raised these topics with them compared to the proportion of respondents earlier declaring that AEWs provided advice on good nutrition (Table 47).

[40] All significant differences mentioned in this paragraph were statistically tested ($p<0.05$).

Table 47. Nutritional topics raised by AEW during the past year

Topics raised	Control N=13	Treatment N=218
Reserving some food to eat after harvest	54%	89%
Planting various foods	69%	86%
Eating eggs	31%	65%
Planting moringa	31%	61%
Vaccinating chickens	54%	58%

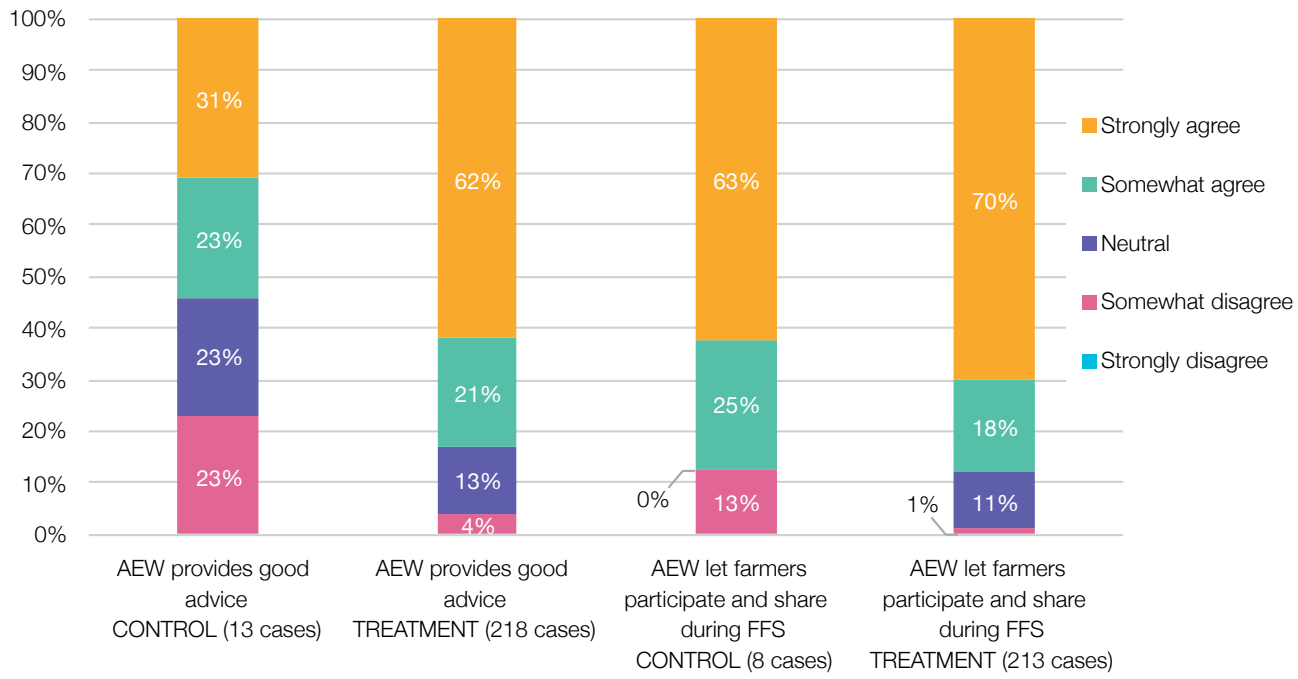
General advice (planting various foods and reserving food after harvest) was shared with almost all expansion farmers – close to 90% – while more specific topics (moringa, eggs, chicken vaccination) were shared with about 60% of expansion farmers.

Interestingly, women more often received advice on eating eggs and vaccinating chickens than men, suggesting that AEWs tend to target nutritional advice towards women: 72% and 67% vs. 56% and 52% among men respondents.[41]

Farmers' perception of AEW services

In order to collect farmers' perception of AEW services, respondents were asked whether they agreed or not with the following statements: (1) "I feel confident that my AEW provides me with good farming advice", and (2) "During Farmer Field Schools, my AEW gives me the opportunity to ask questions and share my experiences". Answers are summarised below.

Figure 16. Farmers' perception of the services provided by AEWs



Overall, treatment farmers were satisfied with AEWs services: only 15% and 11% were neutral or disagreed with the statements. For this question, no statistical association was observed based on

[41] Chi-square test, $p<0.05$.

respondents' gender, wealth or municipality, suggesting that farmers were for the most part equally satisfied with the services delivered by the AEWs.

3.5.2. Overall support received by farmers during the past year

Farmers were asked about the different types of support they received during the past year (not only from AEWs). Such background information is important to assess if other programs/NGOs have also contributed to the impact observed on TOMAK beneficiaries. Also, it is a way for TOMAK to verify that the support provided by the program has indeed been accessed by most expansion farmers. The baseline survey only included a few questions on support. Thus, comparison with baseline data will be discussed later.

Table 48. Support received compared to control farmers, by VC

Type of support received (for free or subsidised)	Mung beans		Shallot/onions		Red rice		Peanuts	
	Con.	Trea.	Con.	Trea.	Con.	Trea.	Con.	Trea.
	N=47	N=79	N=35	N=65	N=9	N=24	N=39	N=56
Seeds	**9%**	**99%**	**0%**	**95%**	**0%**	**96%**	**0%**	**98%**
Source[42]	NGO, AEW	TOMAK, AEW		TOMAK, AEW		TOMAK, AEW		TOMAK, AEW, relative
Training in GAPs	**13%**	**87%**	**6%**	**89%**	**11%**	**79%**	**0%**	**93%**
Source	NGO, AEW	TOMAK, AEW, NGO	NGO, AEW	TOMAK, AEW, NGO	NGO	TOMAK, AEW, NGO		TOMAK, AEW, NGO
Average number of trainings	2.3	1.9	1.5	2.3	2	2.5		2.2
Marketing support	**11%**	**53%**	**0%**	**85%**	**0%**	**67%**	**0%**	**64%**
Source	Relatives, AEW, NGO	TOMAK, AEW		TOMAK, AEW		AEW, TOMAK, local shop		TOMAK, AEW, relatives
Agribusiness training by IADE or BDS	0%	33%	0%	51%	0%	63%	0%	46%
Organic fertiliser	**0%**	**4%**	**3%**	**22%**	**0%**	**29%**	**0%**	**0%**
Source		TOMAK, AEW		TOMAK, AEW, NGO, relatives		AEW, NGO, TOMAK		
Grain-Pro bags	**2%**	**11%**	**0%**	**12%**	**0%**	**42%**	**0%**	**29%**
Source	NGO	TOMAK, AEW, NGO		TOMAK, AEW, NGO		TOMAK, AEW		TOMAK, NGO
Drip irrigation	**0%**	**11%**	**0%**	**66%**	**0%**	**13%**	**0%**	**11%**
Source		TOMAK		TOMAK, AEW		AEW, NGO		TOMAK, AEW, NGO
Inorganic fertiliser	**0%**	**3%**	**3%**	**5%**	**0%**	**29%**	**0%**	**0%**
Source		AEW	Dili shop	AEW, TOMAK		AEW, TOMAK, NGO		
Access to thresher	**0%**	**2 cases**			**0%**	**1 case**		
Source		NGO				NGO		
Access to tractor	**0%**	**1 case**	**0%**	**0%**	**0%**	**1 case**	**0%**	**0%**
Source		Other				NGO		
Access to mower					0%	1 case		
Source						TOMAK		

[42] All sources are listed by order of frequency (most frequently reported sources listed first).

The most frequent support expansion farmers received were seeds (close to 100% of expansion farmers), GAP training (close to 90%) was the next most commonly received, followed by marketing support and training in agribusiness. Note that "GAP training" is delivered during FFSs, which all expansion farmers have attended (as such percentages should have been 100% but the terminology used in the question might have been confusing).

Only a small proportion of farmers received support on fertilisers. Drip irrigation was available through TOMAK and AEWs only for shallot/onion producers. The program team confirmed that only shallot/onion producers purchased drip irrigation so the 18 expansion farmers from other VCs who declared having received drip irrigation were most likely mistaken.

Overall, 26 expansion farmers reported having been trained in GAPs by NGOs and four received fertilisers from NGOs. In many cases, farmers were probably referring to TOMAK's FFS for the GAP training (not an NGO). Yet, other NGOs such as World Fish are working in the same areas as TOMAK and may also have trained expansion farmers and distributed inputs for free (although this may not have occurred during the past year, some farmers might have still referred to this).

On the other hand, control farmers reported minimum support: about 10% declared having been trained in GAPs by NGOs (some NGOs also run FFSs) and AEWs, 9% of mung bean farmers received seeds (NGOs/AEWs) and 11% received marketing information (from relatives, AEWs or NGOs). Other sources of support were anecdotal.

Further analysis of the support received by treatment farmers revealed a number of points:[43]

- Men expansion farmers more often received the following support: (1) subsidised drip irrigation (32% vs. 20% among women), (2) marketing information (75% vs 54% among women), (3) agribusiness training (51% vs 36% among women). Clearly, ensuring equal access to program support by men and women beneficiaries is crucial.
- Wealthier expansion farmers more often participated in agribusiness training compared to poorer farmers: 51% vs. 34% among poorer farmers. As only a limited number of such trainings were conducted, TOMAK field officers together with AEWs selected the most motivated farmers as well as those already possessing some business skills. This seems to have indirectly resulted in the selection of slightly wealthier beneficiaries.
- Agribusiness trainings have not been facilitated in all municipalities equally: in Viqueque, 82% of expansion farmers have received business training vs. 67% in Baucau and 30% in Bobonaro. This is most likely because there are far fewer beneficiaries in Viqueque and many more in Bobonaro – yet the number of trainings conducted in each municipality did not necessarily reflect these proportions.

As mentioned earlier, baseline data is available for a number of points only:

- 17% received subsidised seeds at baseline vs. 97% at midline,
- 1% (two farmers) received marketing support at baseline vs. 97% at midline,
- 10% received "farming equipment" at baseline vs. 43% at midline (for midline, "farming equipment is a combination of all the inputs listed in Table 48, besides seeds),
- 21% received training at baseline vs. 93% at midline (GAP/business combined).

In other words, it seems that TOMAK started working with farmers who had previously received only very little support. These farmers were mainly selected for their motivation and willingness to learn and to apply new production techniques.

[43] All comparisons reported here were statistically significant: $p<0.05$.

3.6. Farmers' knowledge

3.6.1. Business management practices and knowledge

The following questions were asked to assess farmers' agribusiness skills:

- Did your household develop a business plan before deciding to grow the VC crop?
- Did your household keep a written record of the money you spent on production of the VC crop?
- Did your household keep a written record of the money you earned from sales of the VC crop?
- Do you know how to calculate profit? If yes, which response is correct? (4 possibilities)

This data also responds to indicator 33: "Proportion of farmers trained adopting improved business management practices". Data for indicator 33 is presented in the fourth column of Table 49 ("Among trained expansion farmers"). Only 45% of midline treatment farmers (100 cases) reported receiving agribusiness training. Thus, indicator 33 is calculated among these 100 cases.

Note that no similar data was collected during the baseline survey.

Table 49. Proportion of midline respondents applying business management practices

All VC crops combined	Midline		Among trained expansion farmers N=100	Stat. significant MLt/MLc
	Control N=130	Treatment N=223		
Develop a business plan	65%	77%	85%	*
Keep records on production costs	1%	18%	29%	*
Keep records on income	4%	23%	39%	**
Know how to calculate profit	57%	58%	63%	NS

Mung beans	Midline		Among trained expansion farmers N=26	Stat. significant MLt/MLc
	Control N=47	Treatment N=79		
Develop a business plan	66%	73%	85%	NS
Keep records on production costs	0%	9%	15%	NS
Keep records on income	4%	13%	27%	NS
Know how to calculate profit	55%	61%	77%	NS

Shallot/onions	Midline		Among trained expansion farmers N=33	Stat. significant MLt/MLc
	Control N=35	Treatment N=65		
Develop a business plan	74%	80%	82%	NS
Keep records on production costs	3%	25%	33%	**
Keep records on income	3%	31%	46%	**
Know how to calculate profit	66%	58%	67%	NS

Red rice	Midline		Among trained expansion farmers N=15	Stat. significant MLt/MLc
	Control N=9	Treatment N=24		
Develop a business plan	44%	71%	73%	NS
Keep records on production costs	0%	17%	13%	NS
Keep records on income	0%	17%	27%	NS
Know how to calculate profit	56%	54%	40%	NS

Peanuts	Midline		Among trained expansion farmers N=26	Stat. significant MLt/MLc
	Control N=39	Treatment N=56		
Develop a business plan	59%	82%	96%	**
Keep records on production costs	0%	25%	46%	**
Keep records on income	5%	30%	50%	**
Know how to calculate profit	51%	55%	58%	NS

As shown above ("All VC crops combined"), a high proportion of respondents said they developed a business plan before deciding to grow a VC crop: 65% of control farmers, 77% of all treatment farmers and 85% of expansion farmers trained in agribusiness. Such high proportions (especially among control farmers and non-trained treatment farmers) seem very much overreported as it is unusual for Timorese farmers to have such practices.

On the contrary, only about one third of the trained farmers kept records (on production cost or income) and almost none of the control farmers keep records. Agribusiness training has clearly been beneficial as significantly more expansion farmers keep records. Yet about two-third of the agribusiness trainees have yet to adopt such practices. Note that overall, shallot/onion and peanut producers more often declared keeping records on production costs compared to mung bean and red rice producers.

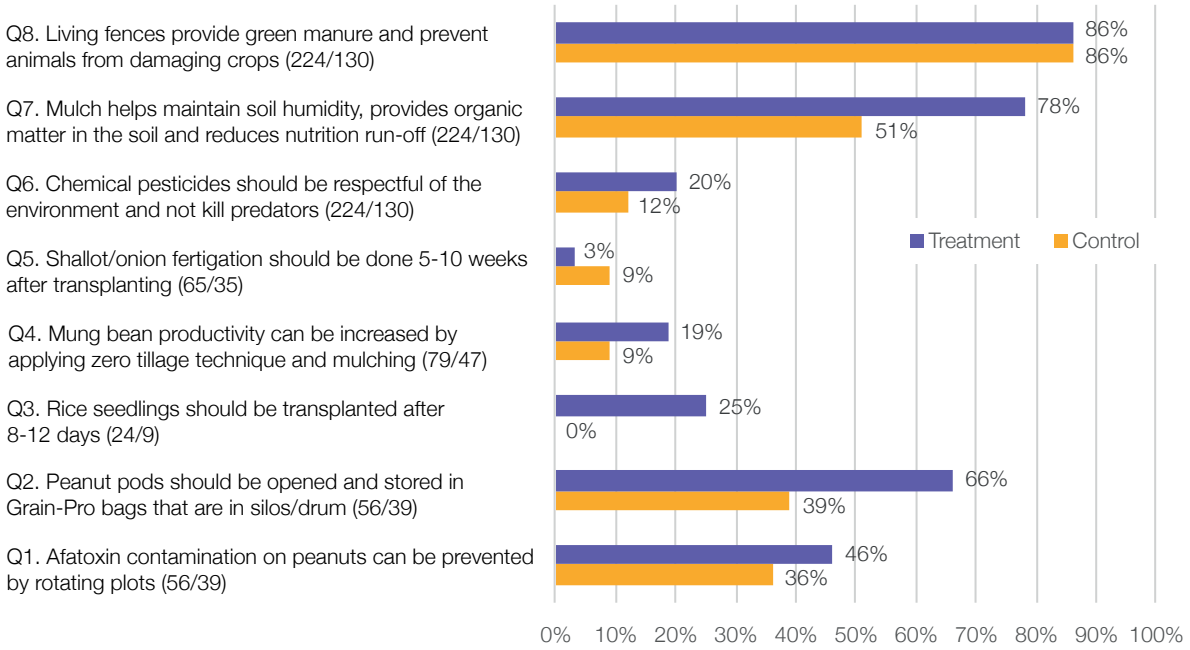
Lastly, about 60% of the farmers surveyed (control/treatment, trained or not) already knew how to calculate profit. Note that wealthier farmers more often selected the correct answer to this question: 73% vs. 43% among the poorer farmers.[44] Wealthier farmers were also most likely the more business-minded.

3.6.2. Agriculture knowledge

Farmers were asked eight technical questions which directly related to skills that were taught to AEWs by TOMAK and which should have been transferred to farmers. For each question, several answers were proposed with only one being the correct one.

[44] Chi-square test: $p<0.05$.

Figure 17. Proportion of respondents selecting the correct answer for agriculture knowledge questions



For six out of eight questions, treatment farmers were more knowledgeable than control farmer but this was statistically significant for three questions only: how to properly store peanut, benefits of mulch and recommendations on proper use of chemical pesticide. In other words, although treatment farmers increased their agriculture knowledge, further capacity building is still needed for many expansion farmers.

There are important disparities between the different agriculture knowledge assessed among treatment farmers. The benefits of living fences and mulch is known to about 80% of farmers. But more specific knowledge such as fertigation timing for shallot/onions, ways to increase mung bean productivity, how to use chemical pesticides and when to transplant red rice was correctly reported by less than 25% of the farmers.

Interestingly, for three questions (questions on Aflatoxin, pesticides and living fences), results were significantly different between treatment farmers of Bobonaro, Baucau and Viqueque: more correct answers in Bobonaro and Viqueque for the questions on pesticides and living fences and more correct answers in Baucau for the question on Aflatoxin. As these differences could actually be linked to the level of support provided in each municipality, further follow-up of capacity building activities could help to harmonise the results.

3.6.3. Nutrition knowledge

Firstly, farmers were asked if they had received information on nutrition during the past 12 months. This was the case for 56% of expansion farmers and 32% of control farmers. Women expansion farmers in particular reported receiving nutrition-related information: 62% vs. 52% of men expansion farmers. The farmers who had received nutrition information were then asked where this information came from:

- For expansion farmers, information came from TOMAK POs (48%), NGOs (47%), health personnel (31%) and media (8%). Only one person mentioned their AEW. This clearly contradicts with the 71% reporting that AEWs shared advice on good nutrition (Table 46).

The reason for this is most likely linked to the different questioning approach: the question asked what type of support AEWs provided in Table 46 while here, the question asked who provided nutritional information.

- For control farmers, information came from health personnel (67%), NGO (29%) and media (17%).

Besides these general questions, a set of specific questions (multiple choices with only one correct answer) were added to test respondent's knowledge of good nutrition. TOMAK had provided training to AEWs on a number of key nutrition-sensitive agriculture messages and these questions were meant to assess if those messages had been passed to expansion farmers. Note that according to the above information, only one expansion farmer recalled receiving nutritional information from an AEW.

Table 50. Proportion of respondents selecting the correct answer for nutrition knowledge questions

Nutrition knowledge	Control N=130	Treatment N=224	Statistically significant
Q1. Proportion of farmers having heard of the 3 food groups	21%	46%	**
Q2. Dark green leafy vegetables and carrots belong to the "Fo Protesaun" food group	11%	27%	*
Q3. Eggs and fish belong to the "Haburas" food group	14%	27%	*
Q4. Bread/rice/corn belong to the "Fo Forsa" food group	19%	47%	**
Q5. "Meat, eggs, tofu, fish, kidney beans" are protein rich foods	20%	34%	*

Undoubtedly, expansion farmers were more knowledgeable about nutrition than control farmers. About half of the expansion farmers had heard about the three food groups and were able to associate carbohydrates to the correct food group ("Fó forsa"). Yet, further efforts are still required as basic knowledge on nutrition remained fairly low among most farmers (54% of expansion farmers had never heard of the different food groups).

Note that in Viqueque, expansion farmers' knowledge on nutrition was often better than in Baucau and Bobonaro. For example, 37% answered correctly to Q2 compared to 30% in Bobonaro and only 14% in Baucau.[45]

Poorer expansion farmers (first tercile) were among the least knowledgeable about nutrition: only 17% answered correctly to Q2 vs. 39% of the wealthiest tercile farmers. Similar observations were made for Q1 and Q4.[46] As a comparison, the same analysis was performed with control farmers' data but no association was observed between the WI and farmers' nutritional knowledge. This could suggest that nutritional concepts need further (and perhaps simpler) socialisation among poorer farmers, who are most likely to be less educated.

3.6.4. Hygiene practices and knowledge

In the DHS section of the survey, which was mainly used for calculation of a WI, two questions were added to assess farmers' knowledge of basic hygiene practices. Results are presented here. No significant difference could be highlighted between control and treatment farmers.

[45] Chi-square test: $p<0.05$
[46] Chi-square tests: $p<0.05$

Table 51. Respondents hygiene knowledge and practices, compared to control group

Hygiene knowledge	Control N=130	Treatment N=224	Stat. significant
When is it important to wash hands:			
Before cooking	58%	62%	NS
After defecation	52%	59%	NS
Before eating	96%	95%	NS
After disposing of child's faeces	17%	17%	NS
Before feeding/breastfeeding	19%	16%	NS
What do you use to wash your hands			
Water only	5%	5%	NS
Water and sand	1%		NS
Water and soap	95%	95%	NS

3.7. Household Decision-making

3.7.1. Decision-making over VC crop production

The midline study included a set of questions about decision-making in relation to the production of the VC crops. Involvement of women in decision-making was assessed either by asking directly "who normally makes decisions", or by asking the respondent how much input did he/she have in the decision. Results are presented below.

Note that only three of the questions below were also part of the baseline survey. But, in the baseline study, those questions did not refer specifically to the VC crops and thus, comparisons with baseline should be interpreted carefully.[47] This will be discussed later.

[47] Only the question on receiving/managing income from crop sale in the red rice/peanut baseline directly related to the VC crops.

Table 52. Women's access and control[48] over VC crop production[49]

	N MLc / MLt	Midline Control	Midline Treatment	Stat. significant
(1) Control over production of VC crops				
% of respondents having control over VC crop production (*How much input did you yourself have in decisions on VC production?*[50])	M R: 63/128 W R: 64/93	M R: 83% W R: 61%	M R: 88% W R: 61%	NS
(2) Access and control over the sale of VC crops				
% of HHs where women have access to VC crop harvests (*In the past year, who in the HH sold the VC crop, the man, women or both?*)	116/185	88%	77%	*
% of HHs where women have control over decisions on VC crop price (*When selling a SMALL/ LARGE amount of the VC crop, who sets the price: the man, women or both?*)	Small: 113/185 Large: 116/186	Small: 89% Large: 90%	Small: 81% Large: 78%	*for large
% of respondents having control over decisions on sale of VC crop (*In the past year, how much input did you yourself have in decisions on selling VC?*)	M R: 56/110 W R: 59/76	M R: 73% W R: 73%	M R: 80% W R: 79%	NS
(3) Control over income generated from sale of VC crops				
% of HHs where women have control over income generated from VC crop sale (*Who receives and manages the income generated from VC sales?*)	115/186	98%	92%	*
% of respondents having control over income generated from VC crop sale (*How much input did you yourself have in decisions on how to use the income generated from VC?*)	M R: 55/110 W R: 59/76	M R: 71% W R: 73%	M R: 73% W R: 83%	NS

- **Control over production of VC crops:** Women seemed to be less involved in the choice of the VC crop to produce in both control and treatment groups: 50% of women respondents felt they were mostly involved vs 85% of male respondents.
- **Access and control over the sale of VC crops:** Women were slightly less in charge of selling the VC crop among treatment farmers than among the control group (77% vs. 88% among the control group). Also, when selling large amounts of VC harvests, women were less involved among the treatment group than among the control group (78% vs. 90% among control farmers).
- **Control over income generated from the sale of VC crops:** Women's control over the income generated is slightly lower among the treatment group: 92% vs. 98% among the control group. This could directly be related to the fact that slightly more men were also in charge of selling the VC crops among the treatment group.

[48] Women are considered as having access or control over resources if they can access resources or decide for these resources on their own (women only) OR together with men (both men and women).
[49] "M R" and "W R" in the table stand for Men Respondent and Women Respondent. These are used to show gender disaggregated results whenever questions relate to respondents' personal involvement in decision-making.
[50] Percentages presented for all the questions on respondents' input in decisions, refer to the proportions of respondents answering "input into most or all decisions" as this expresses the highest control over the resource in comparison to the answers "input into some decisions" and "input into few or no decisions".

In conclusion, differences were not statistically significant, but the above results seem to suggest that expansion farmers give slightly less room to women for the sale of VC crops and consequently, less control over the money generated (especially for large amounts). Perhaps, because the type of agricultural production promoted by the program is more commercial or "professional", then men are more eager to also manage its sale as well as the income generated from this sale.

The following discusses differences between the midline treatment farmers and the baseline:

- **Respondents' input into decisions on crop production:** Both men and women respondents reported they were more involved in production decisions at midline compared to baseline (about 10% more at midline). But the difference was more significant among men respondents: 88% vs. 77% at baseline.
- **Women's control over income generated from crop sales (managing income):** Slightly fewer midline respondents reported that women had control over the generated income compared to baseline[51] respondents: 92% vs. 95% in the baseline.
- **Respondents' control over decisions related to the use of the income generated from crop sales:** Significantly more women respondents felt they could decide on the use of the generated income: 83% vs. 57% among baseline[52] women respondents.

This last finding is interesting as it shows an increase in women's control over resources. Yet, as it is unclear if the baseline question was asked for all crops or for the VC crop alone, this interpretation should be treated with caution.

3.7.2. Decision-making over HH resources

The midline questionnaire also included a longer set of questions related to HHDM in order to assess women's overall decision-making power in the family. Part of this data was used to inform indicator 45: "Proportion of women reporting equitable decision-making authority over HH resources and finances".

The sequence of questions used in this section was inspired from the Women's Empowerment in Agriculture Index (WEAI) and focuses on four areas of inquiry: food crop farming, cash crop farming, livestock raising and large purchases.

For each area, respondents were first asked if they participated in the activity. Only very few farmers (less than 3%) said they were not involved in cash crop farming and livestock raising (less than 3%). They were thus considered as having no decision-making power for those two activities. Others were further asked: (1) who normally makes decisions in the HH (men/women/both), (2) the extent to which they provide input into these decisions, and (3) how satisfied they are with their role in this decision-making.

Note that the baseline did not include similar questions so comparison will be made with the midline control group only.

[51] In the baseline, the question in the mung bean/shallot questionnaire was general to any crop but in the red rice/peanut questionnaire it was specific to the VC crops.
[52] In the baseline, the question in the mung bean/shallot questionnaire was specific to the VC crops but in the red rice/peanut questionnaire it was general to any crop.

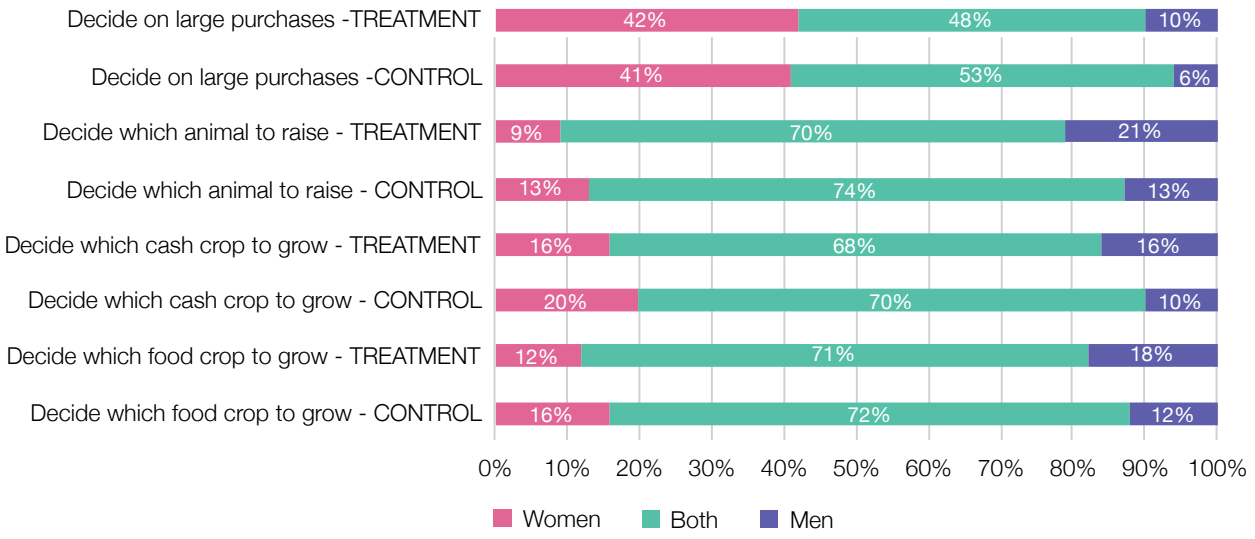
Table 53. Women's participation in decision-making over HH resources

	N	Midline		Stat. significant
	MLc / MLt	Control	Treatment	
Food crop farming in the past 12 months				
% of HHs where women have control over selection of food crops to grow (*Who normally makes decisions on which crops should be grown for food?*)	130/224	88%	82%	NS
% of respondents having control over selection of food crops to grow (*How much input did you have deciding which crops should be grown for food?*)	M R: 63/127 W R: 62/92	M R: 71% W R: 52%	M R: 76% W R: 52%	NS
% of respondents satisfied with their role (*How satisfied are you with your role in making decisions about which crops should be grown for food?*)	M R: 63/130 W R: 67/94	M R: 94% W R: 95%	M R: 97% W R: 95%	Men: **
Cash crop farming in the past 12 months				
% of HHs where women have control over selection of cash crops to grow (*Who normally makes decisions on which crops should be grown for sale?*)	126/219	90%	84%	NS
% of respondents having control over selection of cash crops to grow (*How much input did you have deciding which crops should be grown for sale?*)	M R: 63/129 W R: 64/94	M R: 75% W R: 61%	M R: 78% W R: 67%	NS
% of respondents having control over the use of income generated from cash crops (*How much input did you have in decisions on the use of income generated from cash crop farming?*)	M R: 63/128 W R: 63/93	M R: 70% W R: 81%	M R: 66% W R: 80%	NS
% of respondents satisfied with their role (*How satisfied are you with your role in making decisions about cash crop farming?*)	M R: 61/128 W R: 65/91	M R: 90% W R: 94%	M R: 98% W R: 96%	Men: **
Livestock raising in the past 12 months				
% of HHs where women have control over selection of animals to raise (*Who normally makes decisions on which animals should be raised?*)	127/220	87%	79%	NS
% of respondents having control over selection of animals to raise (*How much input did you have in making decisions about which animals should be raised?*)	M R: 63/129 W R: 64/94	M R: 76% W R: 52%	M R: 81% W R: 60%	NS
% of respondents having control over the use of income generated from livestock raising (*How much input did you have in decisions on the use of any income generated from livestock and livestock products such as eggs?*)	M R: 63/126 W R: 63/90	M R: 70% W R: 78%	M R: 68% W R: 82%	NS
% of respondents satisfied with their role (*How satisfied are you with your role in making decisions about livestock and livestock products?*)	M R: 61/129 W R: 66/91	M R: 97% W R: 98%	M R: 96% W R: 99%	NS
Large purchases (above $30)				
% of HHs where women have control over large purchases (*Who normally takes decisions regarding large purchases over $30?*)	130/224	94%	90%	NS

	N	Midline		Stat. significant
	MLc / MLt	Control	Treatment	
% of respondents having control over large purchases (*How much input did you have in making decisions about large purchases?*)	M R: 63/129 W R: 64/93	M R: 70% W R: 80%	M R: 64% W R: 77%	NS
% of respondents satisfied with their role (*How satisfied are you with your role in making decisions about large purchases?*)	M R: 63/130 W R: 67/94	M R: 79% W R: 91%	M R: 86% W R: 87%	NS
Comfort with expressing disagreement				
% of respondents feeling comfortable telling their spouse that they disagree	M R: 63/130 W R: 67/94	M R: 60% W R: 58%	M R: 56% W R: 54%	NS

For all four areas explored, respondents reported that women were involved in decision-making in 80-90% of the HHs. This was the case in both control and treatment HHs (no statistical association) suggesting the program did not make a significant difference regarding how HHs are already functioning in TOMAK's target areas. Figure 18 shows more precisely the distribution of answers regarding the decision-making questions. For agricultural related questions (livestock, crops), about 70% of expansion farmers said the decision is made by men and women together, i.e. the majority of households. Yet, the proportions of respondents declaring decisions are made together are very similar between the control and treatment group, suggesting TOMAK has not yet had a significant impact in this regard.

Figure 18. Who normally takes decisions related to HH resources



When respondents were asked how much input they have in each type of decision-making, men reported being more frequently involved than women respondents for the selection of which food crops and cash crops to grow, and which animals to raise. On the other hand, women respondents reported being more frequently involved than men respondents in decisions related to: the use of money generated from cash crops and livestock as well as for making large purchases. This is consistent with the data in Figure 18 for decisions related to large purchases, which were frequently

taken by women alone (42% of treatment farmers). These results seem to align with cultural norms in which men are often responsible for income generation activities while women are often responsible for managing the household expenses. Again, no statistical association was observed between control or treatment groups.

In terms of satisfaction with decision-making, most respondents reported being very satisfied with their participation in most decision-making questions. Two results were statistically significant: (1) for food crop farming, more men said they were very satisfied in the treatment group (43% vs. 21% in the control group) and (2) for cash crop farming, more men reported being very satisfied in the treatment group (38% vs. 16% in the control group).

Note that 5% of women were dissatisfied with their role in decision-making for large purchases vs. 2% among men. This is the only area where the option "dissatisfied" and "very dissatisfied" have been selected. This is understandable as it refers to large expenditures which can be a source of conflict, particularly for households with limited resources.

Lastly, the proportions of men and women who felt comfortable expressing disagreement with their spouse were very similar (about 60% at baseline and 55% at midline).

Overall, the above data shows meaningful participation of women in most decision-making questions, although men often have greater input than women in regards to the selection of crops to grow and animals to raise. Only minor differences were observed between the control and treatment group, implying that TOMAK's intervention may have had limited impact on existing gender roles.

Table 54 presents similar data but calculated only among Women in Reproductive Age (WRA) as required for indicator 45: "Proportion of women reporting equitable decision-making authority over HH resources and finances". WRA respondents were considered as having decision-making responsibility for each area if they stated that they had input into most or all decisions related to this area.

Table 54. Proportion of women reporting equitable decision-making authority over HH resources and finances

	N	Midline		Stat. significant
	MLc / MLt	Control	Treatment	
% of WRA reporting decision-making responsibility for which food crop to grow	54/76	46%	58%	NS
% of WRA reporting decision-making responsibility for which cash crop to grow	56/78	59%	69%	NS
% of WRA reporting decision-making responsibility for which livestock to raise	56/78	54%	62%	NS

WRA from the treatment group more frequently reported equitable decision-making than WRA from the control group. Yet, there was no statistical association, suggesting differences are still minor.

Disaggregation by municipality shows increased participation of women in decision-making in Viqueque and less participation in Baucau. For example, 68% of WRA respondents in Viqueque reported decision-making responsibility for which livestock to raise vs. 39% in Baucau.

3.8. Dietary diversity

TOMAK has recently integrated nutrition activities into Component 2 activities (FFS and FFD for relevant target crops) during the January-June 2018 period). The "Minimum Dietary Diversity for Women" (MDD-W) set of questions was therefore included in the midline questionnaire to assess possible impact of this newly introduced intervention.

The mung bean and shallot/onion baseline also included an MDD-W set of questions which was asked only to women respondents. In order for the data to be as comparable as possible, comparison with baseline results is done only for women midline expansion farmers involved in the mung bean or shallot/onion VCs. Results of this comparison are presented in Table 55.

Table 55. MDD-W, comparison with baseline[53]

Food group		Baseline N=32	Midline N=60	Stat. significant
1	Grains, white roots and tubers, plantains	41%	52%	NS
2/3	Pulses, nuts and seeds	41%	55%	NS
4	Milk and dairy products	19%	8%	NS
5	Meat, poultry and fish	31%	50%	NS
6	Eggs	6%	23%	**
7	Dark green leafy vegetables	94%	92%	NS
8	Other vitamin A-rich vegetables and fruits	44%	75%	**
9	Other vegetables	94%	33%	***
10	Other fruits	38%	8%	**
Average MDD-W score		**4.1**	**4.2**	
% of respondents consuming the minimum five food groups		**41%**	**38%**	

When comparing food groups, it appears that HH consumption of eggs and vitamin A-rich vegetables and fruits has significantly increased since the baseline: 23% and 75% for eggs and vitamin A-rich fruits/vegetables vs. 6% and 44% at baseline. This is very interesting as these are the food groups that are specifically promoted by TOMAK.

On the other hand, consumption of other vegetables and fruits has significantly decreased since the baseline: from 94% and 38% respectively at baseline to 33% and 8% at midline. It seems unlikely that these differences are due to the timing of each survey as the baseline was conducted in May, which is not the peak of vegetable production.

MDD-W scores were very similar between baseline and midline. The proportion of women consuming at least five food groups had not increased. In conclusion, no impact can be observed from comparison with baseline data.

Table 56 compares midline control and treatment groups. Results are overall very similar between these two groups and the very little increase in proportion of farmers consuming the minimum five food groups is not statistically significant.

[53] The usual MDD food groups for pulses and nuts/seeds were combined in the baseline data. Thus midline data was computed to be comparable to the baseline data (9 food groups).

Table 56. MDD, compared with control group

Food group		Control N=130	Treatment N=224	Stat. significant
1	Grains, white roots and tubers, plantains	45%	47%	NS
2	Pulses (beans, peas and lentils)	41%	38%	NS
3	Nuts and seeds	33%	38%	NS
4	Milk and dairy products	11%	13%	NS
5	Meat, poultry and fish	47%	51%	NS
6	Eggs	22%	26%	NS
7	Dark green leafy vegetables	95%	95%	NS
8	Other vitamin A-rich vegetables and fruits	64%	72%	NS
9	Other vegetables	26%	27%	NS
10	Other fruits	4%	6%	NS
Average MDD score		**3.9**	**4.1**	
% of respondents consuming the minimum five food groups		**32%**	**36%**	

Table 57 looks at the MDD score and proportion of respondents consuming at least five food groups among women alone and among men alone. Interestingly, for men, very minor differences were observed while for women, dietary diversity was slightly improved among the treatment farmers. Food groups that were more frequently consumed by women treatment farmers were: vitamin-A rich fruits/vegetables, meat/poultry/fish and nuts/seeds.

Differences were not statistically significant but could reveal a new trend for women expansion farmers as the nutrition intervention is still very recent. Indeed, among the food groups that were slightly more frequently consumed by treatment farmers are eggs, vitamin-A rich vegetables and fruits as well as meat/poultry/fish – all of which are being promoted by TOMAK.

Table 57. MDD, compared with control group, among men and women alone

	Control	Treatment	Stat. significant
Among men respondents alone:	**N=63**	**N=130**	
Average MDD score	3.9	4.0	NS
% of respondents consuming the minimum five food groups	30%	32%	NS
Among women respondents alone:	**N=67**	**N=94**	
Average MDD score	3.8	4.3	NS
% of respondents consuming the minimum five food groups	33%	43%	NS

Another finding is the differences between VCs: more peanut expansion farmers consumed at least five food groups compared to other VCs:[54] 54% vs. 34% for shallot/onion farmers, 29% for red rice farmers and 28% for mung bean farmers.

Also, respondents from wealthier HHs more often consumed at least five food groups: 49% in the 3rd tercile vs. 31% and 29% among the 2nd and 1st tercile of the WI.

[54] Chi-square test: $p<0.05$

Discussion and recommendations

4.1. Discussion

In order to promote the development of commercial agriculture, Component 2 has worked together with MAF AEWs on several fronts: input supply, production and market demand. In parallel to this, social behavioural change approaches have also been applied to promote profit-seeking behaviours, women's empowerment and better nutritional habits.

The following sections discuss each of these interventions in light of the midline survey findings.

4.1.1. Access to inputs

Most expansion farmers were confident that they could reliably access inputs (about 80% across the different VC crops) while this was the case for only about 50% of the control farmers. At this stage of the program, this is understandable as most expansion farmers interviewed can still benefit from the 50% subsidy provided by TOMAK for seeds and drip irrigation. Although seed costs constitute only a small percentage of total production costs for mung beans, red rice and peanuts, they are a major cost factor in the production of onion/shallots seeds. Control farmers planting improved varieties had mostly received seeds from NGOs.

To sustain this intervention, it will be important that farmers are able to source quality planting material and other inputs from local agricultural supply stores. TOMAK's FFS approach has greatly supported the emergence of a local demand for higher quality inputs. This should progressively lay the ground for local entrepreneurs to engage in input trading.

The TOMAK program team reported that this was already beginning to happen as local seed production groups were starting to multiply improved varieties promoted by TOMAK. For shallot/onions, importing from abroad will still be needed as the varieties promoted by TOMAK cannot be reproduced locally.

4.1.2. Production

FFSs are facilitated by AEWs who are working closely with TOMAK to increase their capacities. The very large majority of expansion farmers were satisfied or very satisfied with AEWs: 91% said the AEWs visited them at their farm, 83% believe AEWs provide good advice and 88% believe AEWs' approach during the FFS is participatory.

Resulting from this holistic approach, farmers' knowledge appears to have significantly improved: for six (out of eight[55]) agricultural questions and five (out of five) nutrition questions, treatment farmers were more knowledgeable than control farmers. As for business related knowledge and practices, farmers who had participated in IADE trainings more often kept records and knew how to calculate profit. Yet for now, only about a-third of these farmers do keep records.
Some precautions should be taken when assessing the approach of AEWs, as the survey data

[55] Significant difference observed for three questions.

revealed a trend whereby AEWs tend to provide more services to wealthier farmers as well as to male farmers. These differences were not always significant, but it is important for TOMAK to monitor this and to ensure adequate service provision to poorer farmers as well as women farmers.

Reliability of the quantitative data

Unfortunately, measuring the impact on production cost, production volumes and productivity remains a challenge as most farmers had low levels of education and did not keep records (after being trained, only 29% kept records on production costs and 39% on income). As a result, some key results still seem highly questionable:

1. Production costs were the highest by far for shallot/onions (3,883USD/ha) followed by red rice (959USD/ha), peanuts (427USD/ha) and mung beans (271USD/ha). These figures reflect well the various levels of investment needed for each crop but doubts remain on a number of expenses which might not fully be attributed to the VC crops.
2. Volumes produced as declared by farmers seem lower than TOMAK's field team observations, especially for shallot/onions: about 300kg for mung beans and shallot/onions, 645kg for peanuts and 950kg for red rice. TOMAK's technical team also observed problems with data collected concerning the area sizes, which could possibly be a result of confusing terminology in regard to "area size": "owned land area" vs. "cultivated area" vs. "planted area" vs. "harvested area".
3. Average productivity could be calculated for a limited number of respondents only: 1.2T/ha for mung beans (slightly lower than at baseline), 19.7T/ha for shallot/onion (six times the baseline productivity), 1.5T/ha for red rice and 2.3T/ha for peanuts.
4. Average volumes sold per farm were larger among expansion farmers than among control farmers for shallot/onions, red rice and peanuts (respectively 171kg, 282kg and 316kg sold). For onions/shallots, this represents up to 62% of the total volume harvested. This confirms that TOMAK beneficiaries are becoming more commercially oriented.

Adoption of Good Agricultural Practices

As the observation of quantitative data only provides limited evidence of the program's impact on farmers' production, it is crucial to look into farmers' agricultural practices as the uptake of GAPs would most likely have had an impact on production volumes.

Significant uptake was indeed observed: at midline farmers applied 40% of GAPs compared to only 23% at baseline. The uptake was even more pronounced for shallot/onion producers: from 25% to 61% of GAPs applied at midline. Practices that were commonly used were: ploughing organic matter in the soil, planting shallot/onion seeds in nurseries and then transplanting on raised beds, using drip irrigation for shallot/onions and rotating crops. The use of mulching and organic fertilisers was also more frequent (about a third of expansion farmers vs. 5-10% at baseline). These results suggest good uptake of recommended practices, and potentially greater productivity than what farmers reported in interview.

Note that for mung beans and red rice, uptake of a number of GAPs was still limited (no significant difference with control farmers, which could be attributed to the fact that most of the GAP intervention on mung beans has been focused on introducing new seed varieties that allow a one-time harvest). Lower uptake was observed for ploughing for mung beans, terracing, transplanting rice seedlings at a younger age, use of organic pesticides for mung beans, harvesting and shelling rice in shorter time spans to get more uniform grain moisture levels between grains before drying, using a mung bean thresher to reduce labour and intercropping mung beans with cassava or maize to increase productivity.

No farm equipment had been distributed to farmers as of the end of 2020. TOMAK had started small scale trials with new farm equipment at the end of 2020, which may have had only limited impact at the time of data collection for this midline survey. Small scale trials have been conducted for; rice mowers (August/September 2020), threshers (August/September 2020), peanut shellers (July/August 2020) and mini-tillers (December 2020).

There was no relationship between the proportion of GAPs that farmers applied and whether farmers were visited by AEWs at their farm or during FFS/FFD. Possible factors to explain this include: (1) AEWs less frequently visiting farmers than what they reported, (2) AEWs only informing farmers once in groups (during the FFS), but with no individual follow-up, and (3) when visiting farmers, AEWs not sufficiently reinforcing improved practices.

Overall, TOMAK's intervention has helped to develop the use of more sustainable practices among early adopters, although 60% to 70% of expansion farmers are still not applying these improved practices. Continued follow-up support by AEWs during TOMAK Phase 2 will likely help increase adoption rates among late adopters as well.

Other factors impacting on production data

A number of issues should also be taken into account when considering production results from this survey. Firstly, most of the expansion farmers interviewed in the midline survey were fairly new to the program (about 85% of current expansion farmers joined the program in 2019-2020). TOMAK's approach has shifted from establishing small demplots, with consequent training of involved farmers at FFSs and FFDs to focus more on expansion farmers, who have larger areas and production potential. The number of expansion farmers has increased exponentially; from two in 2018 to 408 in 2020. Their production results might vary overtime as they gain experience. On the other hand, the motivation of some farmers might also decrease as subsidies for production inputs are reduced.

Secondly, 2020 was marked by COVID-19 and successive State of Emergency measures taken by the government. Among these measures, the closure of marketplaces in all municipalities for two months (March-April 2020) might have discouraged a number of farmers from investing too much in commercial crops due to a reduction in market access and consumer demand. No questions related to this aspect were asked in the midline survey, but the widespread impact of the pandemic is something to bear in mind when assessing development of the agriculture sector in Timor-Leste.

The planting season in December 2019 – February 2020 was also affected by the late arrival of rains, resulting in crop failures especially for red rice and mung beans. In contrast, the months of March-April 2020 experienced heavy rains and winds that damaged the nurseries for onion/shallot seedlings.

4.1.3. Access to market

TOMAK has facilitated farmers' linkages with buyers. As a result, 79% of expansion farmers feel confident that they can access collectors to sell their products and 57% have collectors coming to buy products at farm gate. Significantly fewer expansion farmers listed "access to market" as a constraint for their crop production. This is especially striking for shallot/onion producers (only 13% of expansion farmers consider this as a constraint) given the high availability of cheap shallot/onions imported from China which they are competing against.

Again, there is a tendency for AEWs to more frequently support male farmers to link with buyers, probably because most AEWs are men and are therefore providing closer support to men. To sustain this intervention, it is important to ensure that men and women have equal access to such services.

4.1.4. Women's economic empowerment and social inclusion

TOMAK mainstreams gender in all its interventions. AEWs and TOMAK POs received gender training and social inclusion training. Gender equality and social inclusion best practices for FFS/FFDs were also socialised to all facilitators. As a result, men and women were equally satisfied with AEWs with regards to the advice they provided and their facilitation skills during FFS, pointing to a participatory approach being taken.

The HHDM questions revealed that women had slightly more input than men into decisions related to the use of income generated from cash crops as well as for large purchases. Yet, when looking at the production of TOMAK's VC crops only, men were more often involved in important decisions such as (1) the selection of which VC crop to grow, (2) the sale of the harvest and (3) the management of the income generated.

These differences were stronger in the treatment group than in the control group. This could be because farmers consider that commercial farming, as it is being promoted by TOMAK, rather falls under men's responsibility. Also, the fact that AEWs have engaged male farmers more often than female farmers for linkage with buyers and input suppliers, could reinforce this feeling.

Interestingly, production of mung beans was the VC that involved the most women in its various production stages. It was also among mung bean producers that more women respondents said they were involved in most or all decisions related to production and use of income. Red rice or shallot/onions on the other hand were rather dominated by men. This is interesting as it provides TOMAK with an opportunity to engage more specifically with women on certain crops.

TOMAK programming appears to be engaging people with light disabilities with relatively similar results experienced by these people. Only one person with a significant disability was interviewed for the midline.

4.1.5. Nutrition

Despite the fairly recent integration of nutrition activities within Component 2, survey data showed that knowledge on nutrition had already improved (higher proportions of treatment farmers responded correctly to the five nutrition questions). Women especially gained knowledge in nutrition and more frequently received such information. Yet it seems like there is still room for improvement with AEWs as a source of nutrition information, as most farmers received nutrition information predominantly from TOMAK's POs and only one farmer from an AEW.

No significant impact on dietary diversity could be observed yet. However, a slightly higher consumption of eggs, vitamin-A rich vegetables/fruits and proteins was observed among treatment farmers compared to control farmers. This could reflect a trend induced by the recent integration of nutrition in Component 2 activities.

4.2. Recommendations

The following recommendations are made based on the survey findings. These are suggestions which need to be further explored, taking into account to the program team's practical knowledge of the challenges and opportunities in TOMAK's target areas. These recommendations can also serve as a basis for more brainstorming and discussion among team members during the design process of TOMAK Phase 2.

4.2.1. Access to inputs

- **Facilitate local entrepreneurs to access and sell quality inputs:** For inputs that need to be imported from abroad (improved variety seeds, drip irrigation equipment), identify local importers (like Vinod Patel and Loja Agi Agrikultura) and collaborate with them to make these inputs available in their shops in Dili and to agricultural supply stores at municipal level.
- **Increase women's access to inputs:** Ensure women expansion farmers know how and where to access quality inputs. If input suppliers are difficult to reach (in municipal towns only), encourage expansion farmers to coordinate for bulk purchase of seeds for example. Farmers could also collaborate with collectors who are regularly selling products in municipal towns and therefore could purchase seeds for farmers in those shops. Another possibility is linking them to commercial seed producer groups in their area; especially for crops like rice and corn.
- **Distributing inputs through farmer groups:** Facilitate contact between farmer group representatives and large importers in Dili (Vinod Patel and Loja Agi Agrikultura) in order for farmer groups to buy directly from these importers at discounted wholesale prices. In addition, these farmer groups can sell these agricultural inputs to members (and non-members) for a profit.

4.2.2. Production

- **Disease management:** This was the most commonly stated production constraint, especially for red rice, mung beans and peanuts. Specific trainings in control of common diseases should be continued for all VCs. Meaningful participation of women expansion farmers in these trainings is important, especially for mung beans and peanuts as women raised concerns about disease management more frequently than men for those two crops.
- **Agribusiness training:** Refresher/targeted training could be useful to encourage more farmers to keep records. Involving literate family members in such sessions is crucial. Whenever possible, field staff should also try to involve motivated poorer expansion farmers, adapting the content, methods and schedule of training to their capacity.
- **Follow-up of FFS:** Conduct simple pre and post-tests before and after FFSs as well as short follow-up surveys a few weeks after the FFS to assess how much knowledge has been acquired during FFSs. This will help identify if specific knowledge needs to be strengthened in some areas for example. An example from the midline data is the need to strengthen knowledge on how to transplant younger rice seedlings or the importance to speed-up harvest and threshing to allow better drying of grains. Additional training for farmers on post-harvest management is recommended.
- **Water management:** Water is a major bottleneck in agricultural production all over Timor-Leste. Consider more emphasis on water management in Phase 2; especially regarding water harvesting, water storage and water conservation.

- **Coaching of AEWs:** Survey data showed that there is no relation between the proportion of GAPs that farmers apply and whether the farmers are visited by AEWs at their farm or during FFS/FFD. This could suggest that AEWs are not sufficiently informing farmers about GAP practices or reinforcing these practices in their visits. Close coaching of the AEWs to ensure they understand the principles of GAPs and are transferring their knowledge to farmers is important. Introduction of a "visitor" book for farmers could be a first step to monitor how often AEWs are visiting farmers and what topics they are discussing with them. In addition, follow-up visits with expansion farmers are needed to motivate farmers on the four VCs promoted by TOMAK, since it takes considerable time before farmers are convinced to expand into larger areas for these VC crops.
- **Organic fertiliser and pesticide:** Continue to promote the use of organic fertilisers and pesticides as only about one-third of expansion farmers are currently using them. Shallot/onion producers are the only ones regularly using compost because compost/organic fertilisers are not feasible on large scale crops (such as rice fields). Therefore, fertiliser trials in Phase 2 are recommended to compare both organic and inorganic fertiliser specifically with onion/shallots and at the same time link the private sector supply stores to distribute fertilisers to farmers at municipal level.
- **Mechanisation:** Increase farmers' access to agricultural equipment that can improve productivity and reduce women's labour burden, including mowers, threshers, shellers and weeders. Farmer have shown strong interest in this new equipment. TOMAK can facilitate farmer groups to purchase such tools for economy of scale and/or rent them out to non-members as a new business opportunity.
- **Storage:** Ensure all expansion farmers are able to access subsidised Grain-Pro bags, especially for red rice which is the VC crop with the highest proportion of farmers listing "storage" as a post-harvest constraint. Identify cheap and local solutions for storage of shallot/onions (large net bags) as one-fifth of expansion farmers store their harvest directly on the floor/ground. Coordination with collectors in this regard could be useful to ensure farmers are using storage techniques that are appreciated by collectors.
- **Production measurement:** Implement a consistent monitoring system for measuring the area size of the harvested crop as well as the weight of the produced crop. Consider recruiting staff that will focus on monitoring of production specifically (area size and crop weight produced) in each municipality.

4.2.3. Access to market

- **Continue to identify local entrepreneurs:** For crops or target areas where access to market is still a major constraint, the program should continue to identify local entrepreneurs willing to become collectors and support them in this initiative. Ideally this could be the most entrepreneurial farmers that are supported by TOMAK, as well as the farmer groups that TOMAK has started to organise in the last quarter of 2020. Where possible, motivated and business-minded women should be encouraged to specialise in collection of mung beans and peanuts.
- **Increase linkages with the more vulnerable farmers:** Collaborate closely with collectors working in TOMAK's target areas to ensure women and poorer expansion farmers are also visited whenever they have products to sell. Meetings between farmers and collectors could be organised to help them to better understand each other, and develop trust and confidence among them.

- **Creation of production nodes:** Selling to traders at farm gate was more frequent among treatment farmers, which shows the value of creating production nodes that attract buyers and collectors. Recommend expansion of production nodes with increasing production volumes in order to attract larger collectors.

4.2.4. Women's economic empowerment and social inclusion

- **Further gender awareness raising at all levels:** Survey data showed that improvements in shared HHDM are starting to happen but are still limited. Indeed, behavioural change is a long-term process and it is important to continue gender awareness raising through various forms (training, workshops, one-time events/competitions) and among all program beneficiaries, partners as well as field teams.
- **Specifically target certain crops:** Specifically engage with motivated women farmers to participate in mung bean and peanut FFSs as women are more frequently involved in production activities for these two crops and have more decision-making power.
- **Increase women's participation in agribusiness training:** Women are traditionally more involved in the management of HH money. Yet, survey data suggests that for the VC crops, women were less involved in financial decision-making than they usually are for food crop farming for example. A number of things can be done to improve this situation: (1) identify more female FFS participants to join agribusiness training (in 2020, fewer women participated in such trainings), (2) engage especially with women mung bean and peanut producers, (3) ensure IADE training materials are adapted to women's needs/activities (use real case examples of women mung bean and peanut producers during the training to explain record keeping for example).
- **Promote inclusion of farmers with disabilities:** Consider approaches to better include people with disabilities across TOMAK programming. This should include the strengthening of knowledge and skills of program staff and MAF extension staff to promote and enable inclusion of farmers with disabilities.

4.2.5. Nutrition intervention

- **Strengthen AEW skills in promoting NSA:** Continue to support AEWs to promote NSA practices with farmers to further strengthen the link between agriculture and nutrition (carried out through parallel program implementation with TOMAK Component 1).
- **Consider an integrated approach with TOMAK Component 1:** Include production and Savings & Loans with nutrition layered throughout the approach. Focus on reinforcing family nutrition information using simple messages and promote the uptake of improved nutrition practices.
- **Regularly promote handwashing with soap:** Include messages on basic hygiene practices (washing hands) in the nutrition materials distributed by TOMAK as well as through regular field implementation, with a particular focus on hand washing at critical times.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Annex I – List of sukus surveyed

SUKU	Number of treatment farmers interviewed	Number of control farmers interviewed
BAUCAU MUNICIPALITY		
Administrative post of Baucau		
Bucoli	1	
Buruma	2	
Gariuai	10	
Tirilolo		19
Triloca	2	
Uailili	5	
Administrative post of Venilale		
Bada-Ho'i		2
Baha Mori		15
Uailaha	4	
Uatu Haco	3	
Uma Ana Ico	1	1
Administrative post of Vemasse		
Caicua	1	
Loilubo	1	
Ostico	5	
Uaigae	1	
Uato-Lari	4	
Vemasse	8	
Administrative post of Laga		
Soba		1
Tequinaumata	4	
TOTAL BAUCAU	52	38
BOBONARO MUNICIPALITY		
Administrative post of Bobonaro		
Atu-Aben	1	
Lourba		9
Soileco	2	
Administrative post of Maliana		
Holsa		29
Lahomea	3	
Odomau	4	

SUKU	Number of treatment farmers interviewed	Number of control farmers interviewed
Raifun	11	
Ritabou	15	
Tapo Memo	38	
Administrative post of Cailaco		
Atudara	5	
Manapa	7	
Meligo	3	
Raiheu		15
Administrative post of Balibo		
Balibo Vila	12	
Batugade	15	
Cowa	9	
Leohito	4	
Leolima	14	
Administrative post of Atabae		
Aidabaleten		21
Hataz	2	
TOTAL BOBONARO	**145**	**74**
VIQUEQUE MUNICIPALITY		
Administrative post of Viqueque		
Bahalaraua'in	3	
Bibileo		18
Luca	6	
Uma Uain Craic	11	
Administrative post of Ossu		
Uabubo	3	
Uaguia	4	
TOTAL VIQUEQUE	**27**	**18**

Annex II – Summary of data cleaning actions

Respondent ID	Questionnaire section	Issue	Action
1319, 1291	Respondent info	Inconsistency in number of HH member (total different from actual number)	Changed total HH members to be the sum of actual members reported per age/sex category
1243	Respondent info	Age of respondent: 2 years old	Age replaced by 999
1111, 1035, 1134, 1131, 1228	School of HH members	Mentioned that boys of the HH aged 5-17 years old were going or not to school BUT previously, said there were no male in this age category in the HH	Changed information on school attendance to 99 (not relevant) as no boys of that age in the HH
1198, 1258, 1311, 1203, 1287, 1102, 1010	School of HH members	Mentioned that girls of the HH aged 5-17 years old were going or not to school BUT previously, said there were no female in this age category in the HH	Changed information on school attendance to 99 (not relevant) as no girls of that age in the HH
1157	Income sources	For sources of income, selected pension and "none"	Unselected "none"
1005, 1148, 1106, 1303, 1201, 1058, 1225, 1245	Income sources	In "other", mentioned business activities which could have been included in an existing category: "business"	Unselected "other" and selected " business"
1148, 1058, 1225, 1245	Income sources - biggest source	Selected "other" as the main source of income but "other" has been re-categorised as "small business" during data cleaning	Changed main source of income to small business
1207	Crops grown in the last 12 months	Shallot/onion was not selected even though shallot/onion is the VC for which the respondent was interviewed for	Selected shallot/onion as a grown crop too
1350	Crops grown in the last 12 months	Red rice was not selected even though red rice is the VC for which the respondent was interviewed for	Selected red rice as a grown crop too.
1173	Crops grown in the last 12 months	Peanut was not selected even though peanut is the VC for which the respondent was interviewed for	Selected peanut as a grown crop too
1344, 1327, 1081, 1350	Section on which crops sold	Says crop is not sold even though in other sections (Agricultural practices and % of harvest sold), it is said that the crop was sold	Selected "sold" as well in the section of all crops grown
1057, 1055, 1030, 1023, 1024, 1080, 1054, 1069, 1153, 1038, 1058, 1078, 1029, 1070, 1001, 1097, 1036, 1003, 1114, 1071	Units from the last harvest that are sold/kept/ consumed, etc.	All information in units sold was 999 even though the respondent already said the number of units harvested and gave information on % sold/consumed/ etc	Changed the number of units sold/consumed, etc. according to the % reported in the next question
1208	Units produced in the last season	Said know how many units were produced but then in # of units produced, said "don't know"	Changed "know how many units produced" to "don't know"

Respondent ID	Questionnaire section	Issue	Action
1180	Units from the last harvest that are sold	No information entered for units sold while in all other questions, said no red rice sold	Entered "0" for number of units sold
1221, 1142, 1024, 1080, 1095, 1073, 1006, 1332, 1171	14. Agricultural Practices	In question on selling, said do not sell VC crop but in all other parts of the questionnaire said sell VC crop	Changed "no" to "yes"
1172, 1054, 1213, 1207	Sale of crops (list of all crops)	Said do not sell the crop here even though in all other sections about the sale of the VC crop, said sell the VC crop	Changed "no" to "yes"
115	Sale of crops (list of all crops)	Question not answered even though in all other sections about the sale of the VC crop, said sell the VC crop	Selected "yes" as an answer
1173, 1335, 1151, 1347, 1166, 1157, 1336, 1206, 1036, 1068, 1269, 1114, 1313, 1178	Q7: list of crops grown that are sold	The question on whether the VC crop was sold in the past 12 months was not asked (empty cell) but in other sections, it is clear that some of the harvest was sold (or clear that was NOT sold).	Selected the corresponding answer in Q7 (sold or Not sold depending on the info from other sections)
1347, 1310, 1085, 1349, 1241, 1291	Gender of head of HH	Gender of head of HH did not match the name of the person	Selected the right gender
1328, 1268	Gender of respondent	Gender of respondent did not match the name of the person	Selected the right gender
1024	size of land cultivated	Outlier identified: 400mx400m total land size	After cross-checking with enumerator, it appears the correct land size is 40mx40m
1229, 1226, 1075	size of VC crop land	Outlier identified	After cross-checking with M&E coordinator, it appears these are mistakes.
1243, 1127	size of VC crop land	Size of VC crop area is the same as size of total land but it is impossible as the farmer grows mung beans and rice	Changed size reported for VC crop to 999
1049	Q19 on production costs	The cost "land leasing" was selected even though in other sections (Q20 on amount of this cost and Q10 on ownership) it seems that no cost was spent and the land is owned/not rented	Unselected "land leasing" in Q19
1004, 1331	Q19 on production costs	The cost "seed" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "seed" in Q19
1004, 1032	Q19 on production costs	The cost "organic fertiliser" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "organic fertiliser" in Q19
1004, 1242	Q19 on production costs	The cost "inorganic fertiliser" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "inorganic fertiliser" in Q19
1004	Q19 on production costs	The cost "inorganic pesticide" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "inorganic pesticide" in Q19
1004, 1214	Q19 on production costs	The cost "irrigation equipment" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "irrigation equipment" in Q19

Respondent ID	Questionnaire section	Issue	Action
1260, 1236	Q19 on production costs	The cost "other" was selected even though in Q20 on amount of this cost, the related cost entered is "0" or left empty	Unselected "other" in Q19
1067, 1048	Q20 on production costs AMOUNTS	Seed costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	Cross-checked with team
1242, 1306, 1250	Q20 on production costs AMOUNTS	Inorganic pesticide costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1315, 1314, 1196, 1295	Q20 on production costs AMOUNTS	Inorganic herbicide costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1012, 1003, 1078, 1004, 1014	Q20 on production costs AMOUNTS	Tractor rental costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1226	Q20 on production costs AMOUNTS	Transport costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1093, 1075	Q20 on production costs AMOUNTS	Storage costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1227, 1244, 1135, 1123, 1097	Q20 on production costs AMOUNTS	Hired labour costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1094, 1075, 1071, 1135, 1078, 1083	Q20 on production costs AMOUNTS	Other costs identified as an outlier on Stem-and-Leaf plot and by comparison with other answers	
1092, 1063, 1212, 1111	Q21 - constraints on production	The option "no constraint" was selected as well as other existing constraints	Unselected the option "no constraint"
Not reported here	Q21 - constraints on production	In the section to write what are the other constraints, several cases had constraints that could have been entered in other options (mostly disease due to pest attack)	Reorganized the option "other" and added a new category: "animal damage crop"
1111, 1080, 1084	Q21 - constraints on post-harvest	The option "no constraint" was selected as well as other existing constraints	Unselected the option "no constraint"
1041, 1114, 1084	Q on storing during the last 12 months	Answered "no" (no VC crop stored during the last 12 months) but in Q23 said some of the last harvest was stored for seed	Changed No to Yes
1225, 1137, 1330	Q24 Marketing, ways of selling VC crop	The selected answer is "no" (no sale) even though in the question on agricultural practices, it says some VC harvest was sold	Changed "no" to "999"
1023, 1047	Q25 - PRICE	Highest price reported was lower than the smallest price reported	Switched the 2 prices
1037	Q25 - PRICE	Most common price was above the highest price mentioned	replaced the amount for common price by 999
1021, 1333	Q25 - PRICE	Most common price was lower than the lowest price mentioned	replaced the amount for common price by 999
1066	Q25 - PRICE	"0" was entered for all prices (lowest/ highest/common" because the farmer had not sold VC crop	Replaced "0" by 999

Respondent ID	Questionnaire section	Issue	Action
1248, 1052	Q29 - ANIMAL RAISED	First the farmer said they raise animals but in the following questions on number of pigs/chickens etc., all numbers are "0"	Entered "999" for the question on whether the farmer is raising animals (instead of "yes"). And deleted all "0"s for the number of each animal
1207, 1208, 1278, 1135, 1352, 1182	Q11.c - Size of plots for VC crop	Abnormally large bed sizes for shallot/ onion (120m/130m)	Cross-check with enumerator: the width of the bed is 1.2m or 1.3m > changed the width to 1m
1090	Q11.c - Size of plots for VC crop	Total VC area is too large: 17 plots of shallot/onions which are 2m wide and 45m long each	Set as an outlier
1130, 1057, 1279	Q11.c - Size of plots for VC crop	Total VC area is too large: identified as extreme outlier with n boxplot	Set as outlier
1135, 1208, 1352, 1090, 1278, 1227, 1010, 1025, 1181, 1017, 1019, 1073, 1064, 1163, 1162, 1037, 1279, 1188, 1288, 1046, 1161, 1233, 1333, 1131, 1165, 1209, 1217, 1016, 1216, 1272, 1133, 1183, 1204, 1210, 1211, 1213, 1220, 1222, 1224, 1271, 1289, 1215, 1044, 1214, 1177, 1129, 1146, 1185, 1203, 1263	Q11.c - Size of plots for VC crop	Information on size of plots/beds with VC crop was not complete as the respondent reported more than 5 plots/ beds with VC crop but information on size was gathered for 5 plots/beds/only	Made extrapolations on the size of other plots/beds based on the information provided on the size of the first 5 plots/beds (averages)
1197, 1239, 1274. 1297, 1239, 1209, 1092, 1198, 1237, 1238, 1258, 1277, 1274, 1297, 1308, 1183, 1144, 1111, 1112, 1143, 1212, 1275, 1328, 1329, 1330, 1331, 1239, 1209, 1092, 1198, 1237, 1238, 1258	Q15 agricultural input sources	Enumerator selected "other" for most sources of inorganic fertiliser/pesticide/ herbicide	Changed to "local shop" after confirming with enumerator what he actually meant (local shop at municipal level)
1236	Q14 on agricultural practices	Said did not use organic fertiliser even though later (Q19) said spent money on organic fertiliser	Selected yes for the use of organic fertiliser in Q14
1064, 1134, 1135, 1188, 1256, 1269, 1278, 1289	Q14 on agricultural practices	Said did not use inorganic fertiliser even though later (Q19) said spent money on inorganic fertiliser	Selected yes for the use of inorganic fertiliser in Q14
1068, 1019, 1073, 1119, 1147, 1169, 1262, 1263	Q14 on agricultural practices	Said did not use inorganic pesticide even though later (Q19) said spent money on inorganic pesticide	Selected yes for the use of inorganic pesticide in Q14
1134, 1192, 1169, 1105, 1348	Q14 on agricultural practices	Said did not use inorganic herbicide even though later (Q19) said spent money on inorganic herbicide	Selected yes for the use of inorganic herbicide in Q14
1188, 1064	Q14 on agricultural practices	Said did not use inorganic fungicide even though later (Q19) said spent money on inorganic fungicide	Selected yes for the use of inorganic fungicide in Q14

Respondent ID	Questionnaire section	Issue	Action
1041, 1081, 1188, 1128, 1133, 1038, 1172, 1236, 1249, 1294, 1115, 1283, 1105, 1073	Q14 on agricultural practices	Said did not plough with a tractor (or did not plough at all) even though later (Q19) said spent money on tractor	Selected yes for ploughing with tractor and ploughing overall in Q14
1227, 1021, 1223, 1267, 1244, 1192, 1243, 1065, 1220, 1159, 1253, 1156	Q24 - Do collectors come to your farm to buy the VC crop?	Answered NEVER to this question event though in the following question, one of the ways of selling the crop was "to a trader at the farm gate"	After cross-checking with enumerator, changed "NEVER" to "sometimes"
1067, 1046, 1041, 1141, 1353, 1118, 1016, 1104, 1289, 1304, 1098, 1333, 1143, 1297, 1315	Q24 on ways you sold VC crop	The answer selected in the following question (In the past year, what was the MAIN way you sold your {value_chain_name} crop?") was not part of the answers selected in this question	Added the option selected as the main way of selling in the answers of the first question.
1002	Q25 on price	Abnormal price for red rice	Cross checked/enumerator and corrected price
1184, 1274, 1044, 1275, 1276, 1161, 1183, 1197, 1210	Q11. on cropping seasons	Reported 3, 4 or 5 cycles of shallot/onion	Cross checked/enumerator: he misunderstood the question. The actual answer is: 1 cycle
1118, 1188, 1012, 1252, 1136	Q13. Support received	Selected "own farm" as the source of the support - which means it is not a support received from outside.	Selected that the respondent did not receive this support
1179	Overall interview	The farmer has not harvested yet his VC crop and shouldn't have been interviewed	Consultation with TOMAK: decide to exclude all information from this interview related to production/harvest/agricultural practices/ support/production costs (besides ploughing and planting which was done already)
1004, 1012, 1242, 1250, 1306, 1093, 1196, 1242, 1295, 1314, 1315, 1096, 1135, 1227, 1244, 1018, 1019, 1038	Q20 - Production cost amount	Abnormally high production costs for certain items	Cross-checked with TOMAK as these are abnormal - replaced by 999
1075, 1093	Q20 - Production cost amount	Abnormally high production costs for certain items	Cross-check with enumerators: it is a typing error: replaced by correct number
1003	Volume produced - Before Q22	Abnormally high volume produced (82 tons)	Replaced by 999
1075	Volume produced - Before Q22	Abnormally high volume produced (7.7 tons of peanuts)	Replaced by 999

Annex III – Coding of variables used in the Principal Component Analysis for the Wealth Index

Questions	Answers which were coded as "1" for improved	Answers which were coded as "0" for unimproved
10 questions on ownership of animals (pig, goat, sheep, chicken, fish, cow, buffalo, horse, dog, duck)	HH owns at least 1	HH does not own any
Total cultivated land size (not only under VC crops)[56]	1 ha or more	Less than 1 ha
House floor material	Cement, ceramic tiles, finished floor/parquet	Palm/bamboo, rudimentary floor wood planks, dung, natural floor/ earth/sand
House roof material	Wood, metal/zinc,	Palm/bamboo, thatch/palm leaf, natural roofing/no roof
House walls material	Cement blocks/covered adobe, bricks, stone sith slime/cement, finished walls cement,	Other, cardboard, plywood, uncovered adobe, stone with mud, rudimentary walls bamboo with mud, dirt, cane/palm/trunks/bamboo, natural walls/no walls
Hand washing station	Have one	Doesn't have
25 questions on ownership of HH assets (electricity, solar panel, radio, television, tape/cd player, mobile phone, fixed phone, computer, refrigerator, fan, chair, sofa, cupboard, bed, sewing machine, electric iron, watch, bicycle, motorcycle, animal-drawn cart, car/truck, tractor/hand-tractor, thresher, boat, bank account)	Owns	Doesn't own
10 questions on ownership of animals (pig, goat, sheep, chicken, fish, cow, buffalo, horse, dog, duck)	HH owns at least 1	HH does not own any

Questions	Answers which were coded as "1" for improved	Answers which were coded as "0" for unimproved
10 questions on ownership of animals (pig, goat, sheep, chicken, fish, cow, buffalo, horse, dog, duck)	HH owns at least 1	HH does not own any
Total cultivated land size (not only under VC crops)[56]	1 ha or more	Less than 1 ha
House floor material	Cement, ceramic tiles, finished floor/parquet	Palm/bamboo, rudimentary floor wood planks, dung, natural floor/ earth/sand
House roof material	Wood, metal/zinc,	Palm/bamboo, thatch/palm leaf, natural roofing/no roof
House walls material	Cement blocks/covered adobe, bricks, stone sith slime/cement, finished walls cement,	Other, cardboard, plywood, uncovered adobe, stone with mud, rudimentary walls bamboo with mud, dirt, cane/palm/trunks/bamboo, natural walls/no walls
Hand washing station	Have one	Doesn't have
25 questions on ownership of HH assets (electricity, solar panel, radio, television, tape/cd player, mobile phone, fixed phone, computer, refrigerator, fan, chair, sofa, cupboard, bed, sewing machine, electric iron, watch, bicycle, motorcycle, animal-drawn cart, car/truck, tractor/hand-tractor, thresher, boat, bank account)	Owns	Doesn't own
Does your household own the house you live in?	Yes	No
How many sleeping rooms does your house have?	1 to 2 HH members per room	3 or more HH members per room
What is your household's main source of DRINKING WATER?	Water piped to garden, water piped to house, water piped to neighbours, connected to public water system, protected well or water source/spring, ppen water source/spring.	Water piped from river, closed well, unprotected water source/spring, closed water source/spring.
What type of TOILET or LATRINE does your household have or share?	Flush or pour flush toilet flush to septic tank, flush to pit latrine, pit latrine ventilated, improved pit latrine, pit latrine with slab.	Flush to somewhere else, flush, don't know where, pit latrine without slab/ open pit, no facility / bush / field, flush to pit latrine – shared, flush or pour flush toilet flush to septic tank – shared.
What is your household's main source of COOKING FUEL?	Kerosene, electricity	Charcoal, wood, straw

[56] This variable was not accepted in the PCA as data was missing for too many cases.

Annex IV – Conversion of local measurements for volumes produced to kilograms

Local measurement	Kilograms (of seeds/shallot/ onions/rice/nuts)
Mung beans	
50kg sacks (coffee, sugar)	60kg
Hoka (big sack) 1 ton	1T of pods = 350kg of seeds
30kg rice sacks (Globus, AA)	35kg
25kg rice sacks	20kg
Lata mina 12kg	12kg
Shallot/onions	
50kg sacks (coffee, sugar)	45kg
30kg rice sacks (Globus, AA)	25kg
25kg rice sacks	15kg
Lata mina 12kg	7kg
Red rice	
50kg sacks (coffee, sugar)	40kg
Jumbu sack (cement) 1 ton or hoka 1 ton	850kg of paddy = 550kg of rice
30kg rice sacks (Globus, AA)	25kg
25kg rice sacks	20kg
Peanuts	
50kg sacks (coffee, sugar)	35kg
Jumbu sack (cement) 1 ton or hoka 1 ton	600kg of pods = 420kg of nuts
30kg rice sacks (Globus, AA)	20kg
25kg rice sacks	10kg

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