

Grow Against the Flow: Scaling off-season vegetable innovations to increase farmers' income and improve nutrition in Cambodia and Lao PDR

Baseline Survey Results



Photo 1: Field day for Chaisim production in Tboung Khmum province, Cambodia

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1 Purpose

This baseline study is part of the Grow Against the Flow (GAF) project, which began in 2020, and aims to increase the production and consumption of safe vegetables through the scaling of off-season vegetable production technologies in Cambodia and Laos. Off-season is defined as a season outside the regular crop production season and includes the dry (March to May) and wet (June to October) seasons. The regular season falls between November to February. The Grow Against the Flow project uses demonstration sites in Cambodia and Laos in which the benefits of improved cultivars, IPM practices, protective structures and water conservation technologies for off-season vegetable production are displayed. This study is aimed at providing reference point data on a set of output and outcome indicators against which the impacts of the project can be assessed. The output indicators of the project include the number of farmers trained and number of farmers exposed to the technologies. The project outcomes include the adoption of off-season technologies, hectares under vegetable production, amount of produce sold, price and income.

1.1 Objectives of the study

1. To examine the socioeconomic characteristics of the households
2. To describe the adoption status of off-season technologies for vegetable production
3. To estimate the area coverage of the brassica, yardlong bean and tomato and compare this with the coverage of staple crops
4. To estimate the amount of crop produce sold and income.

2 Methodology

2.1 Study sites and sampling

The study was conducted in Kampong Cham, Kampot and Tboung Khmum provinces in Cambodia and Vientiane Capital and Vientiane provinces in Laos in June 2021 (Figure 1). A total

of 9 districts, 22 communes and 33 villages were reached in Cambodia and 6 districts and 22 villages in Laos.

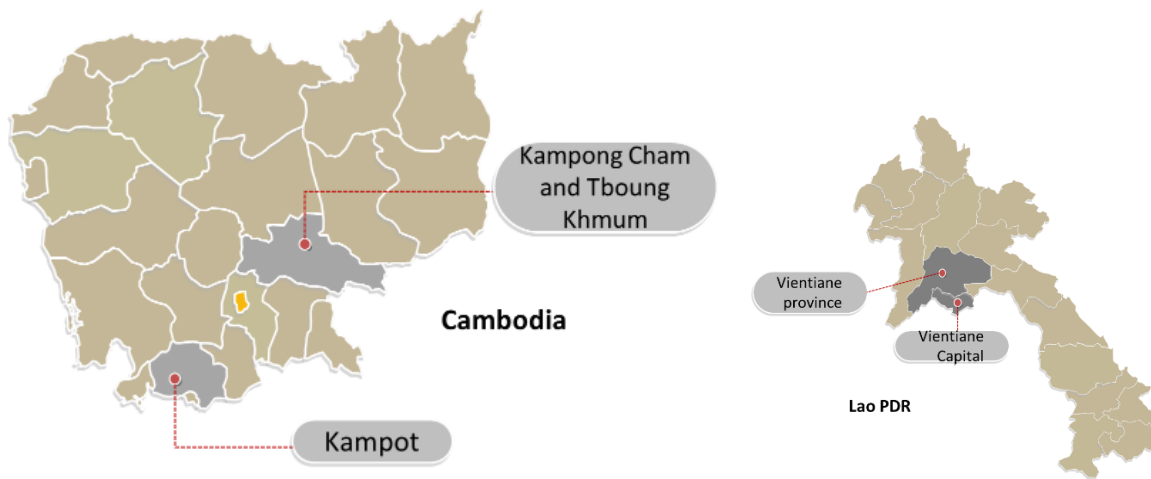


Figure 1: Map of the study area

Source: Adapted from <http://yourfreetemplates.com>

The sampling followed these steps: i) provinces and districts that have active vegetable production activities were identified in consultation with the local partners i.e. Clean Agriculture Centre (CAC) for Laos and East West Seed for Cambodia; ii) provinces and districts had to be located in areas where the partners implements their projects; iii) intervention and control villages were also identified by partners and had to be 5-10 km apart to minimize contamination during the intervention process; iv) village elders provided a list of vegetable farmers to participate in the survey. The target was to get 10-15 farmers per village. Based on power calculations we aimed at 448 farmers in each country. However, there were concerns about finding sufficient farmers which led to the revision of the number of farmers in Laos downwards to 360 and the final sample size was 361. A sample size of 461 farmers was reached in Cambodia. **Table 1** shows a summary of the number of provinces, districts, villages and farmers sampled in Cambodia and Laos.

Table 1: Distribution of sampled farmers by location and treatment

Province	District	Number of villages		Number of farmers	
		Intervention	Control	Intervention	Control
Laos					
Vientiane Capital	Hatxayfong	2	3	29	40
	Pakngum	0	2	0	34
	Sikhottabong	2	1	22	12
	Xaythany	6	2	103	22
Vientiane	Kasi	3	3	26	48
Total		13	13	180	181
Cambodia					
Kampong Cham	Cheung Prey	2	1	10	6
	Prey Chhor	6	4	65	58
	Kang Meas	0	1	0	1
Kampot	Dang Tong	0	4	0	71
	Tuek Chhou	3	0	37	0
	Chhuk	3	0	47	0
Tboung Khmum	Ponhea Kraek	0	4	0	78
	Tboung Khmum	0	1	0	12
	Ou Reang Ov	6	0	76	0
Total		20	15	235	226

In both countries, enumerators were trained a week before the interview, a pretest done and the questionnaire revised. The interviewees were contacted in advance and asked to give a suitable time for their interview, and the times chosen ranged from 6am to 9pm. Data collection was undertaken for two weeks.

3 Results and discussion

3.1 Sample characteristics

Table 2 shows the characteristics of surveyed households. A total of 822 farmers were interviewed. The mean age of farmers was 47 but in Cambodia farmers in control group were significantly older than those in treatment group. Farmers were smallholders owning less than 2.5ha of land with those in Cambodia having larger parcels than those in Laos. Regarding differences by treatment group, treated farmers in Laos had a significantly large farm size than control farmers.

Table 2: Test of differences between means of key characteristics of vegetable farmers in Cambodia and Laos, Baseline survey, 2021

Characteristic	Cambodia				Laos			
	Pooled	Control	Treated	t	Pooled	Control	Treated	t
Age (years)	47.13	49.11	45.22	-2.18**	46.98	47.46	46.51	-0.81
Sex (1=female, 0 otherwise)	0.50	0.55	0.45	-1.22	0.44	0.46	0.43	-0.29
Land size (ha)	2.37	2.27	2.45	0.25	1.36	0.95	1.77	2.34**
<i>Households migrating by season (1=yes, 0 otherwise)</i>								
Wet season	0.19	0.20	0.18	-0.38	0.16	0.16	0.17	0.22
Dry season	0.18	0.19	0.17	-0.41	0.16	0.14	0.17	0.70
<i>Household growing vegetables, by season (1=yes, 0 otherwise)</i>								
June	0.97	0.98	0.97	-0.92	0.98	0.97	1.00	1.57
November	0.73	0.70	0.76	0.87	0.96	0.95	0.97	0.39
March	0.82	0.81	0.84	0.78	0.85	0.87	0.83	-0.42
<i>Households growing different types of crops (1=yes, 0 otherwise)</i>								
Yardlong bean	0.63	0.62	0.64	0.23	0.31	0.12	0.49	2.89***
Brassica	0.50	0.63	0.37	-3.08***	0.65	0.71	0.58	-0.95
Tomato	0.06	0.10	0.03	-1.95*	0.06	0.05	0.06	0.16
<i>Use of off-season technologies</i>								
Overall (number)	3.59	3.42	3.77	1.05	4.50	4.82	4.18	-1.03
Wet season (number)	3.14	2.90	3.37	1.40	4.07	4.46	3.69	-1.08
Dry season (number)	2.97	2.72	3.20	1.43	4.27	4.47	4.07	-0.63
Observations	461				361			

Notes: Mar, Jun, Nov denote the dry, wet and regular seasons respectively; *p < 0.1, ** p < 0.05, *** p < 0.01

More than 80 percent of farmers in both countries grew crops in wet and dry seasons. Of the three vegetables targeted by the project, yardlong bean and brassica were relatively common compared to tomato with only 6% of the surveyed farmers practiced tomato growing in both countries. More than 90% of the sampled households used at least one off-season technology in Cambodia and Laos. On average, farmers used about 4 different technologies out of 10 that were asked during the interview. The popular off-season technologies among the respondents include the use of improved seed varieties, followed by investment in water storage and the use of compost manure (**Figure 2**). Sticky traps, plastic tunnels and pheromones were rarely used.

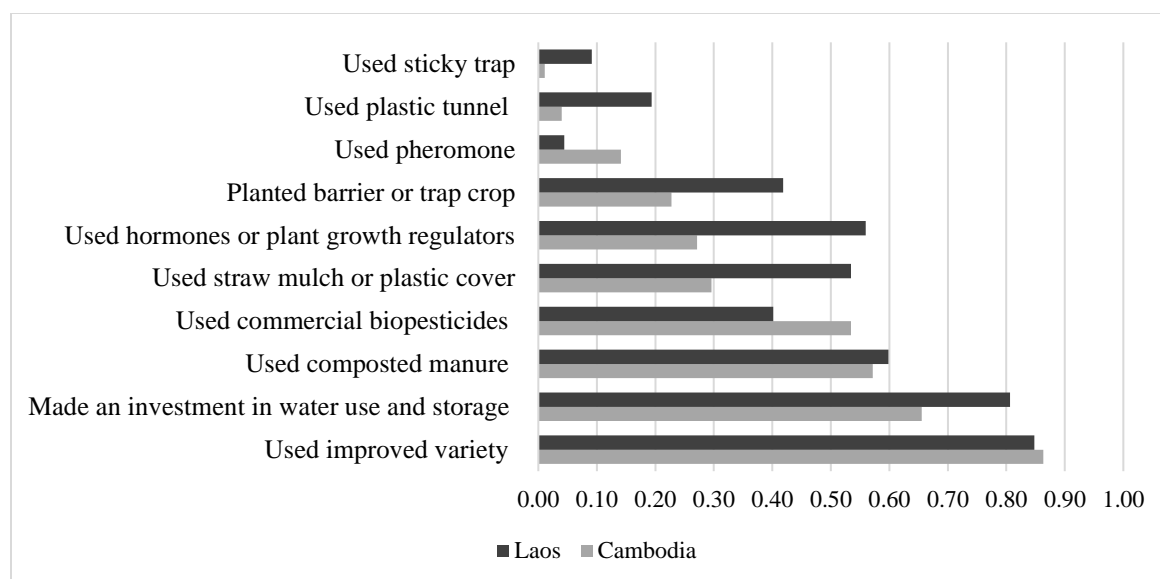
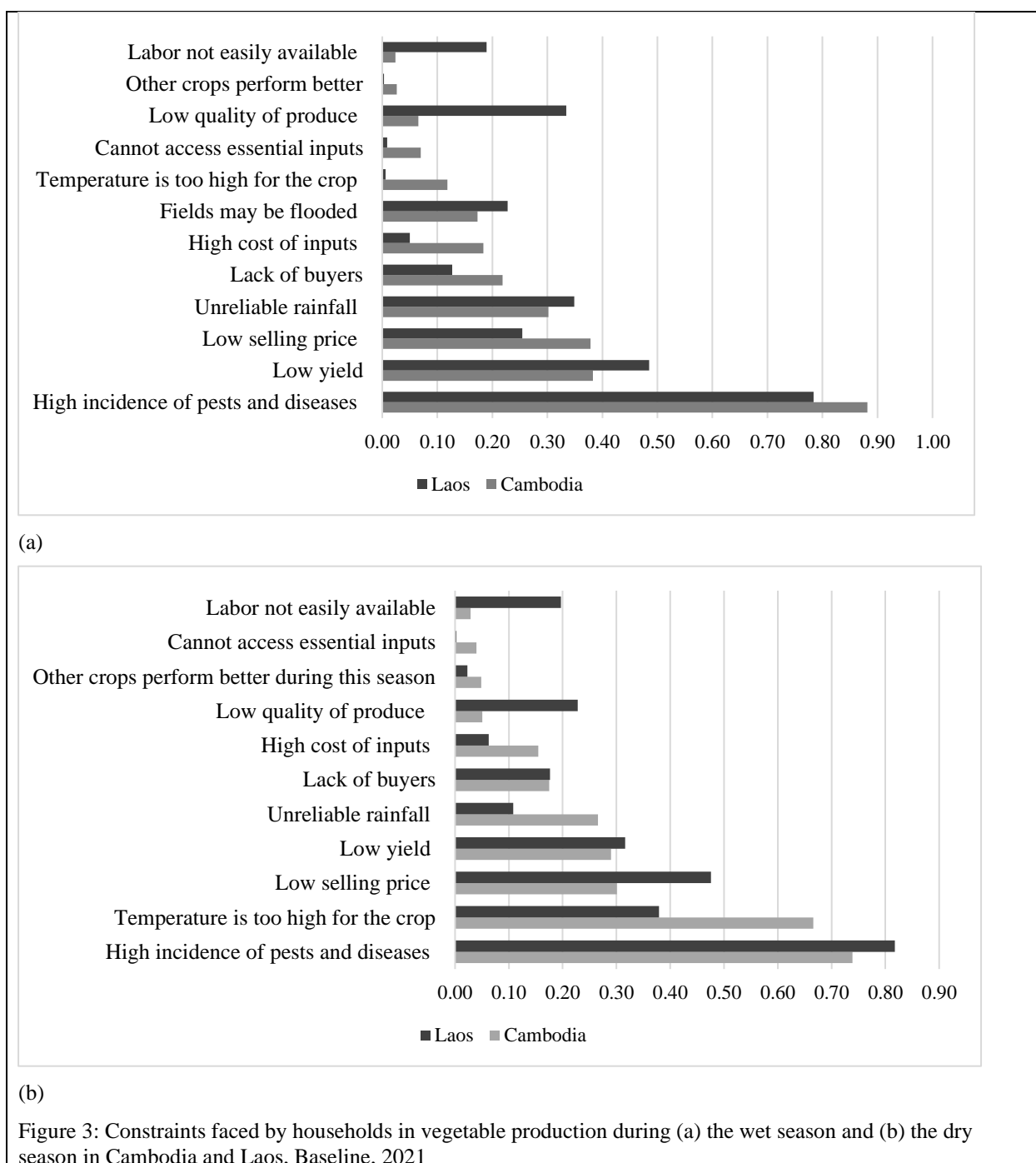


Figure 2: Off-season technologies used by vegetable farmers in Cambodia and Laos, Baseline study, 2021

Every production system faces a set of challenges that can minimize output and performance. Identification of such constraints is critical for the design of effective interventions to alleviate the negative effects on the system. The baseline survey sought to understand constraints faced by farmers in the production of vegetables in off-season. The respondents were asked about 13 constraints as reported in **Figure 3**. High incidences of pests and diseases is a popular constraint in dry and wet seasons as well as low yield and low selling price in both countries. Additional constraints faced in wet seasons as reported by most farmers is unreliable rainfall, a phenomenon that can be related to frequent floods, while for dry season, high temperatures presented a major bottleneck.



Given the importance of COVID-19 pandemic, we assessed the effect of the pandemic on vegetable, rice and livestock production. More than 80% of the sample farmers continued to produce rice and livestock during the pandemic with no changes on the level of production (**Figure**

4). However, vegetable production was greatly affected with about 70% of farmers in Cambodia reporting a decrease.

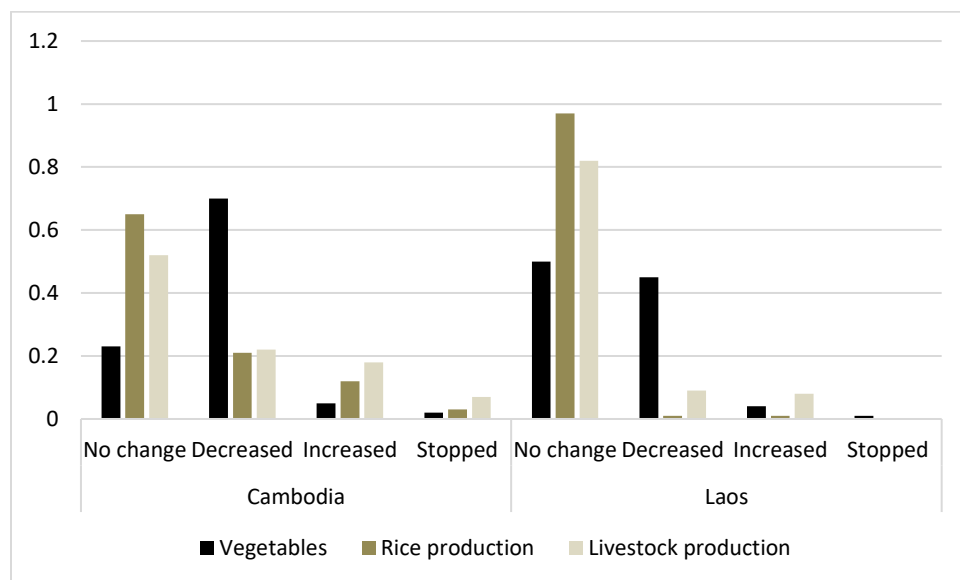


Figure 4: Changes in crop and livestock production due to COVID-19 pandemic

3.2 Key outcome indicators

i. Perception regarding vegetable safety

Improving food safety is an important indicator of success of the GAF project. As shown in **Table 3**, farmers have a good understanding of food safety issues related to vegetable production and consumption. The exception is on farmers' perception on whether farm animals are a source of contamination of vegetables. About 50% and 70% of farmers in Cambodia and Laos, respectively, disagree with this statement.

Table 3: Farmers' perceptions on vegetable safety in Cambodia and Laos, Baseline survey, 2021

	Cambodia				Laos			
Perception on food safety	Pooled	Control	Treated	t	Pooled	Control	Treated	t
Farm animals are an important source of contamination of vegetables (1=agree)	0.49	0.50	0.49	2.90	0.30	0.16	0.44	-6.23
It is okay to put leafy vegetables on the ground after harvesting in the field (1=agree)	0.13	0.18	0.09	2.90***	0.63	0.58	0.69	-2.01*
It is alright to harvest and consume vegetables a day after spraying with pesticides (1=agree)	0.09	0.07	0.12	-1.66**	0.01	0.01	0.02	-0.44
It is unnecessary to clean storage boxes such as crates and baskets after use (1=agree)	0.07	0.11	0.03	3.05*	0.11	0.02	0.19	-5.43

Notes: ratings were based on a 2-Likert scale: 1=agree, 0=disagree; *p < 0.1, ** p < 0.05, *** p < 0.01

ii. Area under production

Farmers were asked to report the size of the plot allocated for production of vegetables including yardlong bean, tomato, and brassica, by season. In addition, farmers reported the plot size under rice, which is the main staple, to act as a comparison crop. As shown in **Table 4**, small piece of plot was allocated to vegetables (0-0.05ha) compared to rice (0.3-0.8ha; which is 30-80 times bigger). Farmers in Cambodia allocated large plots for yardlong bean, tomato, rice and brassica production during the wet season. In Laos, yardlong bean and rice plots were large in the wet season and tomato and choysum in the regular season.

Across groups, in Cambodia and Laos, in dry, wet and regular seasons, the area of plot under yardlong bean was significantly higher for farmers in the treatment group compared to their counterparts in the control group. For rice, farmers in the control group allocated a larger share of land than those in treatment group in Cambodia but the reverse happened in Laos, with farmers in the treatment group having larger plots under rice production than farmers in the control group.

Table 4: Test of differences between means of production area in ha in Cambodia and Laos, by seasons, Baseline survey, 2021

Crop	Season	Cambodia				Laos			
		Pooled	Control	Treatment	t	Pooled	Control	Treatment	t
Yardlong bean	Mar	0.028	0.012	0.044	-4.249***	0.036	0.010	0.061	-4.232***
	Jun	0.057	0.028	0.084	-5.315***	0.050	0.014	0.086	-5.836***
	Nov	0.033	0.014	0.051	-4.368***	0.030	0.011	0.049	-3.628***
Tomato	Mar	0.000	0.000	0.000	1.985**	0.003	0.000	0.007	-2.477**
	Jun	0.003	0.005	0.002	1.417	0.002	0.000	0.004	-2.193**
	Nov	0.000	0.000	0.000	1.949	0.009	0.009	0.009	-0.047
Rice	Mar	0.361	0.456	0.269	2.505**	0.003	0.000	0.006	-0.997
	Jun	0.816	0.911	0.726	2.303**	0.592	0.448	0.735	-4.198***
	Nov	0.136	0.181	0.092	1.995**	0.171	0.012	0.330	-6.969***
Choysum	Mar	0.006	0.005	0.007	-0.694	0.007	0.005	0.010	-1.415
	Jun	0.012	0.011	0.013	-0.474	0.013	0.012	0.014	-0.441
	Nov	0.008	0.005	0.011	-2.300**	0.023	0.025	0.021	0.537
Pakchoy	Mar	0.000	0.001	0.000	2.667***	0.000	0.001	0.000	1.568
	Jun	0.001	0.002	0.001	1.431	0.002	0.004	0.000	3.201***
	Nov	0.002	0.002	0.001	1.080	0.001	0.001	0.000	1.186
Observations		461	226	235		361	180	181.00	

Notes: Mar, Jun, Nov denote the dry, wet and regular seasons respectively; * p < 0.1, ** p < 0.05, *** p < 0.01

iii. Amount of marketed crop produce

The amount of crop produce that was marketed was also asked and reported in local units like bags. The amount in kgs was computed. **Table 5** shows that while farmers in Cambodia sold rice in all the seasons those in Laos sold mostly over the wet season. Overall, farmers in the treatment group in both countries marketed more yardlong bean produce than those in the control group in wet, dry and regular seasons. The differences are statistically significant. The differences between the amount of pakchoy sold between farmers in control and treatment groups in Laos is significant. Farmers in control group sold more.

Table 5: Test of differences between means of amount sold in USD in Cambodia and Laos, by seasons, Baseline survey, 2021

		Cambodia				Laos			
		Pooled	Control	Treatment	t	Pooled	Control	Treatment	t
Yardlong bean	Mar	164.59	33.50	290.67	-3.72***	219.46	79.73	358.42	-3.27***
	Jun	424.63	157.67	681.36	-5.06***	517.05	167.50	864.66	-5.20***
	Nov	244.69	39.45	442.07	-4.91***	250.75	147.27	353.67	-2.14**
Tomato	Mar	0.65	1.33	0.00	1.21	26.06	0.00	51.98	-2.09**
	Jun	50.87	100.29	3.34	2.00**	45.54	0.00	90.83	-1.33
	Nov	0.75	1.08	0.43	0.80	587.80	221.33	952.24	-1.37
Rice	Mar	720.33	1198.54	260.43	3.23***	0.00	0.00	0.00	-
	Jun	2093.47	2537.16	1666.77	1.51	1163.56	799.36	1525.75	-1.33
	Nov	325.39	383.65	269.36	0.99	325.12	0.00	648.45	-4.97***
Choysum	Mar	32.84	35.42	30.36	0.27	45.11	53.47	36.80	0.92
	Jun	65.96	67.68	64.31	0.18	145.50	161.97	129.13	0.70
	Nov	93.77	69.73	116.89	-0.95	254.44	295.83	213.27	0.97
Pakchoy	Mar	1.85	2.35	1.38	0.56	5.25	10.53	0.00	1.88*
	Jun	7.26	8.49	6.09	0.38	32.58	65.33	0.00	3.01***
	Nov	9.27	13.69	5.02	1.15	24.33	43.47	5.30	2.08*
Observations		461	226	235		361	180	181	

Notes: Mar, Jun, Nov denote the dry, wet and regular seasons respectively; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

iv. Price

The average price per kg (in USD) of vegetables is higher than that of rice in Cambodia and Laos (Table 6). Differentiating by seasons, in Cambodia, the price of vegetables in the regular season is higher than in the off-seasons but for rice the price is higher during the off-seasons. In Laos, the average price of vegetables and rice is higher in off-seasons compared to the regular season. Significant differences are observed between treatment and control group in Cambodia with the control group reporting higher prices of yardlong bean during the off-seasons.

Table 6: Test of differences between means of price in USD in Cambodia and Laos, by seasons, Baseline survey, 2021

Crop	Season	Pooled	Cambodia		t	N	Pooled	Laos		t	N
			Control	Treatment				Control	Treatment		
Yardlong bean	Mar	0.47	0.532	0.421	-1.92**	94	0.57	0.845	0.456	-1.13	47
	Jun	0.45	0.520	0.394	-2.54**	235	0.61	0.771	0.559	-0.78	86
	Nov	0.49	0.558	0.458	-1.42	122	0.47	0.418	0.491	0.63	52
Tomato	Mar	0.61	0.614	na	na	3	0.69	na	0.686	na	7
	Jun	0.40	0.405	0.397	-0.11	20	0.37	na	0.369	na	4
	Nov	0.57	0.587	0.494	-2.31	5	0.32	0.274	0.380	1.62	18
Rice	Mar	0.23	0.232	0.228	-0.37	63	na	na	na	na	na
	Jun	0.24	0.241	0.245	0.25	282	0.38	0.444	0.332	-1.43	112
	Nov	0.22	0.218	0.226	1.14	46	0.32	na	0.318	na	37
Choysum	Mar	0.40	0.389	0.407	0.2	48	0.46	0.410	0.485	-0.60	31
	Jun	0.42	0.438	0.404	-0.67	104	0.59	0.598	0.566	-0.19	61
	Nov	0.84	0.376	0.353	-0.31	86	0.41	0.390	0.446	0.54	78
Pakchoy	Mar	0.47	0.442	0.553	1.02	9	0.36	0.361	na	na	4
	Jun	0.46	0.531	0.357	-1.61	13	0.40	0.405	na	na	11
	Nov	0.50	0.508	0.476	-0.35	18	0.41	0.344	0.808	7.67**	7

Notes: Mar, Jun, Nov denote the dry, wet and regular seasons respectively; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; na means there was no record of price

v. Income

The income in local currency was computed using amount harvested and price and the currency converted to US dollars. **Table 7** shows that, overall, the highest income was from rice, followed by yardlong bean and choysum. Pakchoy generated the least income. The treatment group reported statistically higher income from yardlong bean compared to control group in all seasons and countries. There was a statistically significant difference between the treatment and control groups in terms of the income from tomato. In Cambodia, farmers in control group reported higher income from sale of tomato during the wet season than those in the treatment group while in Laos the treatment group recorded higher incomes during the dry season. The control group in Laos reported a significantly higher income from pakchoy compared to the treatment group.

Table 7: Test of differences between means of income from sale of yardlong bean, tomato, rice and brassica in USD in Cambodia and Laos, by seasons, Baseline survey, 2021

		Cambodia				Laos			
		Pooled	Control	Treatment	t	Pooled	Control	Treatment	t
Yardlong bean	Mar	57.13	14.78	97.87	-3.63***	87.44	47.08	127.57	-2.32**
	Jun	162.91	62.89	259.11	-4.51***	306.42	101.94	509.77	-4.84***
	Nov	108.93	23.28	191.30	-4.20***	107.61	59.08	155.88	-2.07**
Tomato	Mar	0.46	0.93	0.00	1.16	18.76	0.00	37.41	-2.00**
	Jun	20.31	40.42	0.98	2.03**	17.47	0.00	34.85	-1.35
	Nov	0.42	0.64	0.21	0.91	178.81	61.91	295.07	-1.36
Rice	Mar	165.57	276.10	59.27	3.16***	0.00	0.00	0.00	-
	Jun	511.31	622.13	404.73	1.59	419.71	313.16	525.67	-1.05
	Nov	70.83	83.10	59.03	0.97	95.46	0.00	190.39	-5.07***
Choysum	Mar	11.28	13.48	9.17	0.60	23.03	28.49	17.59	0.97
	Jun	23.89	24.50	23.29	0.16	74.02	82.70	65.40	0.72
	Nov	30.90	24.85	36.72	-0.74	109.89	123.90	95.97	0.64
Pakchoy	Mar	0.65	0.61	0.69	-0.12	2.16	4.32	0.00	1.71*
	Jun	3.04	3.74	2.37	0.52	14.13	28.34	0.00	2.78***
	Nov	4.26	5.79	2.79	0.87	9.32	14.38	4.29	1.35
Observations		461	226	235		361	180	181	

Notes: Mar, Jun, Nov denote the dry, wet and regular seasons respectively; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4 Conclusion

This survey was done to obtain baseline information on project beneficiaries. The information obtained will be used to measure impact of the planned intervention, which includes training of farmers on off-season vegetable technologies, on production and income in Cambodia and Laos. The survey covered questions on technology adoption, crop production and marketing across the dry, wet and regular seasons and the crops in focus were yardlong bean, tomato, rice, choysum and pakchoy. A total of 822 farmers were surveyed: 461 in Cambodia and 361 in Laos.

More than 80 percent of farmers in both countries grew crops in wet and dry seasons. Our findings imply that farmers in the study areas embrace crop production in off-seasons. Of the three vegetables targeted by the project, yardlong bean and brassica were relatively common compared to tomato with only 6% of the surveyed farmers growing it in both countries. Tomato is not

common or preferred. On average, farmers used about 4 different off-season technologies out of 10 that were asked. The findings suggest that the question of whether farmers use off-season technologies is not sufficient for the GAF project but rather what are the preferred technologies and how effective are these in improving livelihoods. High incidences of pests and diseases is a popular constraint in dry and wet seasons as well as low yield and low selling price in both countries. The indication about low prices is interesting as some literature mentions that prices of vegetables are high in off-season and is one of the strategies farmers are expected to benefit from the adoption of off-season technologies promoted by the GAF project.

Regarding plot size, in both countries, smaller pieces of plots were allocated to vegetables compared to rice underscoring the role of staples in the communities. Larger plots were recorded mostly during the wet season and smaller plots in the dry seasons. This implies that farmers have a higher preference for growing crops in the wet season than dry. Across groups, in both countries, in dry, wet and regular seasons, the area of plot under yardlong bean was significantly higher for farmers in the treatment group compared to their counterparts in the control group.

The average price of vegetables in Cambodia is higher during the regular seasons compared to the off-seasons while the price of rice is higher during the off-seasons but lower during the regular season which is an unexpected finding. While farmers in Cambodia sold rice in all the seasons those in Laos sold mostly over the wet season. Overall, farmers in the treatment group marketed more yardlong bean produce than those in control in wet, dry and regular seasons in both Cambodia and Laos.

5 Suggestions for follow-up

The project will have to put more effort into educating farmers about tomato growing. Qualitative research is crucial to understand farmers' preferences and challenges for using off-season technologies, farmers' opinions on the price of vegetables during the regular and off-seasons and reasons for producing crops in off-seasons. Rice production remains dominant and the GAF project will have to reinforce demonstrations and training in vegetable production to increase awareness of the importance of growing vegetables, especially during off-seasons.

6 Limitations

Key limitation of this study is that interviews were conducted over the phone and therefore detailed information regarding vegetable and rice production and marketing was not asked, for example, the costs of inputs. Additionally, the study was conducted in June meaning that some crops that were grown in March may not have been harvested which can lead to an underestimation of the amount produced, sold, and income.