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# CASSAVA PROGRAM DISCUSSION PAPERS

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## **Value Chain Analysis, Household Survey and Agronomic Trial Results Cambodia**

Chea Sareth, Dominic Smith, Rob Cramb,  
Jonathan Newby and Lava Yadav  
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# Value Chain Analysis, Household Survey and Agronomic Trial Results Cambodia<sup>1</sup>

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<sup>1</sup> This series *Cassava Program Discussion Papers* presents results of the Australian Centre for International Agricultural Research (ACIAR) supported projects ASEM /2014/053 *Developing cassava production and marketing systems to enhance smallholder livelihoods in Cambodia and Lao PDR* and AGB/2012/078 *Developing value-chain linkages to improve smallholder cassava production systems in Vietnam and Indonesia*

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## Country Information

### Production Statistics

During the cassava “boom” from 2009 onwards, Cambodia recorded the most significant rises in harvested area and production volumes of any country in South East Asia. By 2013-2014, cassava production was undertaken in almost all of the 25 provinces of the country (Table 1).

Table 1: Cambodian Cassava Area, Production and Yield by Province (2013-2014)

Province	2013-2014 Season			
	Planted Area (ha)	Harvested Area (ha)	Production (t)	Yield (t/ha)
Banteay Mean Chey	55,666	48,264	953,125	17.1
Battambang	61,695	47,157	1,699,123	27.5
Kampong Cham <sup>5</sup>	67,625	67,446	1,327,847	19.6
Kampong Chhnang	1,737	1,737	10,116	5.8
Kampong Speu	3,402	3,402	101,765	29.9
Kampong Thom	36,725	36,600	530,379	14.4
Kampot	816	816	1,839	2.3
Kandal	27	27	216	8.0
Koh Kong	334	334	6,956	20.8
Kratie	46,810	46,810	1,042,378	22.3
Mondulkiri	10,271	10,271	157,505	15.3
Phnom Penh City	72	72	535	7.4
Preah Vihear	12,650	12,650	139,150	11.0
Prey Veng	1,969	1,969	35,442	18.0
Pursat	6,583	6,583	181,357	27.5
Rotanakiri	13,590	13,356	273,794	20.1
Siem Reap	11,510	10,515	158,763	13.8
Krong Preah Sihanouk	470	470	6,110	13.0
Stueng Treng	19,622	2,910	58,200	3.0
Svay Rieng	17,597	17,352	273,129	15.5
Takeo	1,331	1,331	11,979	9.0
Otdar Mean Chey	25,125	22,850	528,631	21.0
Krong Kep	100	100	1,468	14.7
Krong Pailin	25,648	24,217	433,575	16.9
Total	421,375	377,239	7,933,382	18.8

More than 80 percent of production is concentrated in provinces in the west (Banteay Mean Chay, Battambang, Otdar Mean Chay and Krong Pailin) and the east (Kratie, Kampong Cham, Tbong Khmum and Kampong Thom) of the country. The production in the western

<sup>5</sup> The new province of Tbong Khmum was created by royal decree on 31<sup>st</sup> December 2013 by splitting off the South Eastern portion of Kampong Cham province. The 2013-2014 figures in Table 1 for Kampong Cham refer to the area covered by both the current Kampong Cham province and Tbong Khmum province.



## Province Information

### Production Statistics

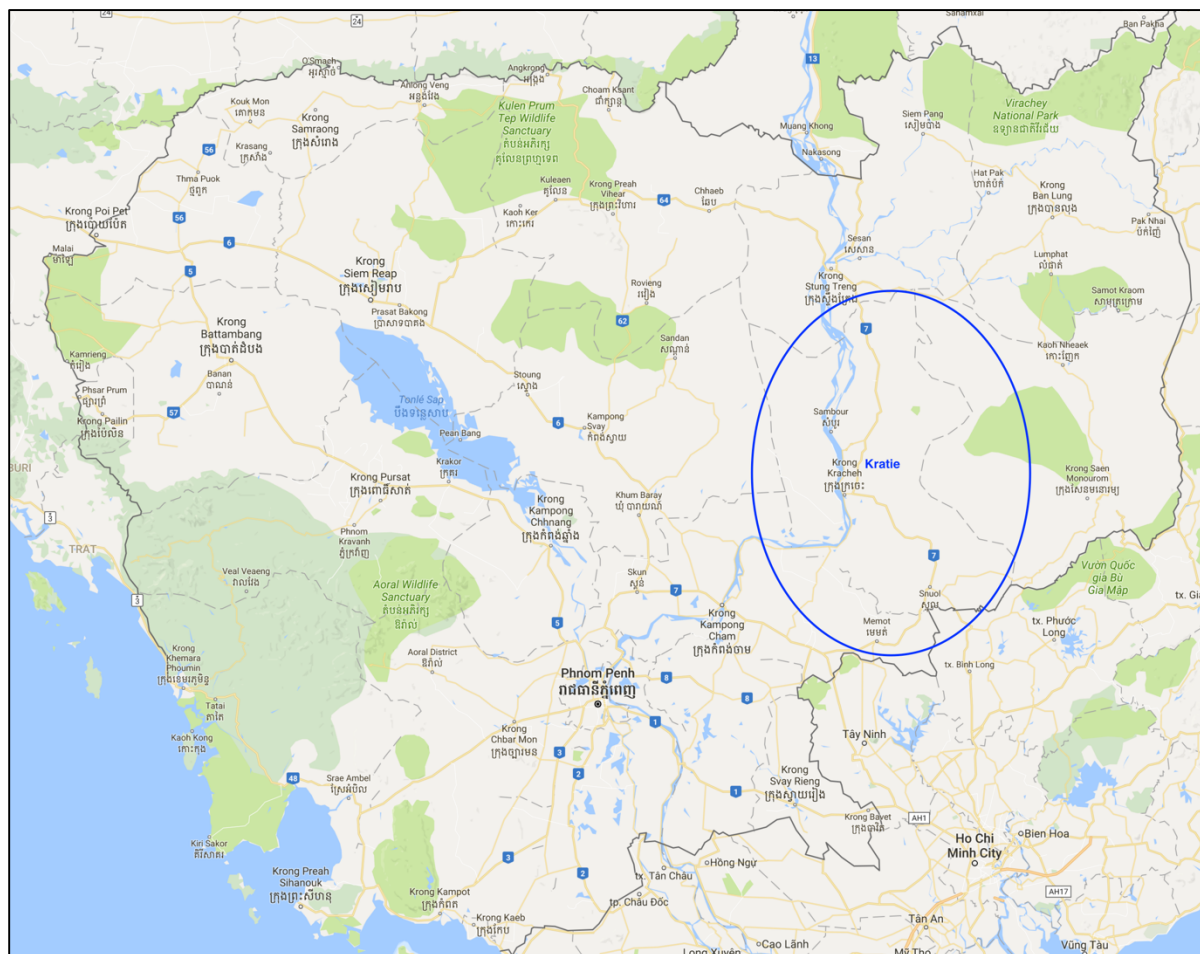


Figure 2: Location of Kratie Province within Cambodia

The provincial production of just over 1 million tons of fresh cassava root in the 2013-2014 season represented around 13 percent of national production (Table 1). The cassava area in 2013-2014 (46,810 ha) was similar to the area of paddy rice planted in the province, but significantly less than the area of agro-industry land concessions (312,577ha).

## Value Chain Information

Given the proximity of Kratie to one of the major Vietnamese cassava processing provinces (Tay Ninh) it is hardly surprising that export oriented value chains predominate in the province. Trade is currently dominated by fresh roots for export through the Chang Riec border gate (between Tbong Khmum Province and Tay Ninh Province). Dry chips are exported through the Te Hoa Lu border gate (between Kratie Province and Binh Phuoc Province) and through the Xa Mat Border Gate (between Tbong Khmum Province and Tay Ninh Province).

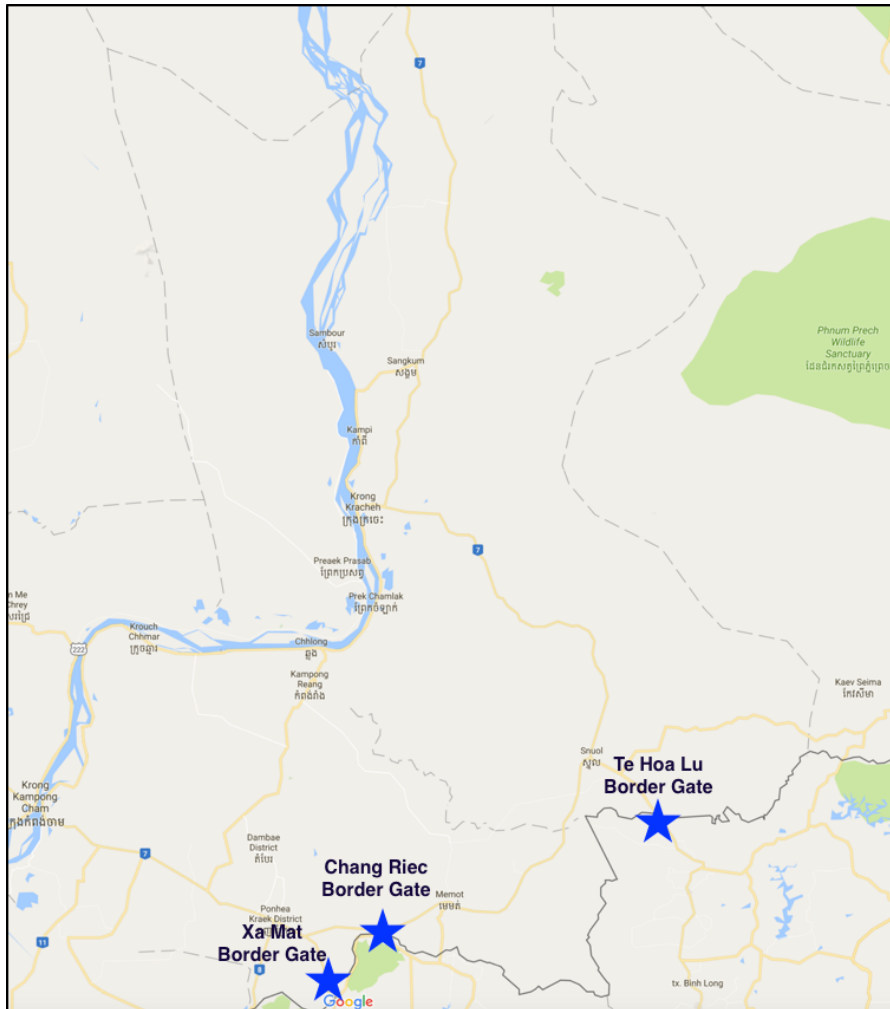


Figure 3: Major export border gates for cassava from Kratie province

### Fresh Root Value Chain

The fresh root value chain from Kratie is predominately oriented towards exports to processing factories in Tay Ninh province in Vietnam. There is some small scale starch processing undertaken near Memot (Tbong Khmum Province) which accounts takes a small proportion of the fresh root from Kratie, but large traders indicated that the cross-border trade was much preferred due to consistent demand, prompt payment and relatively easy procedures.

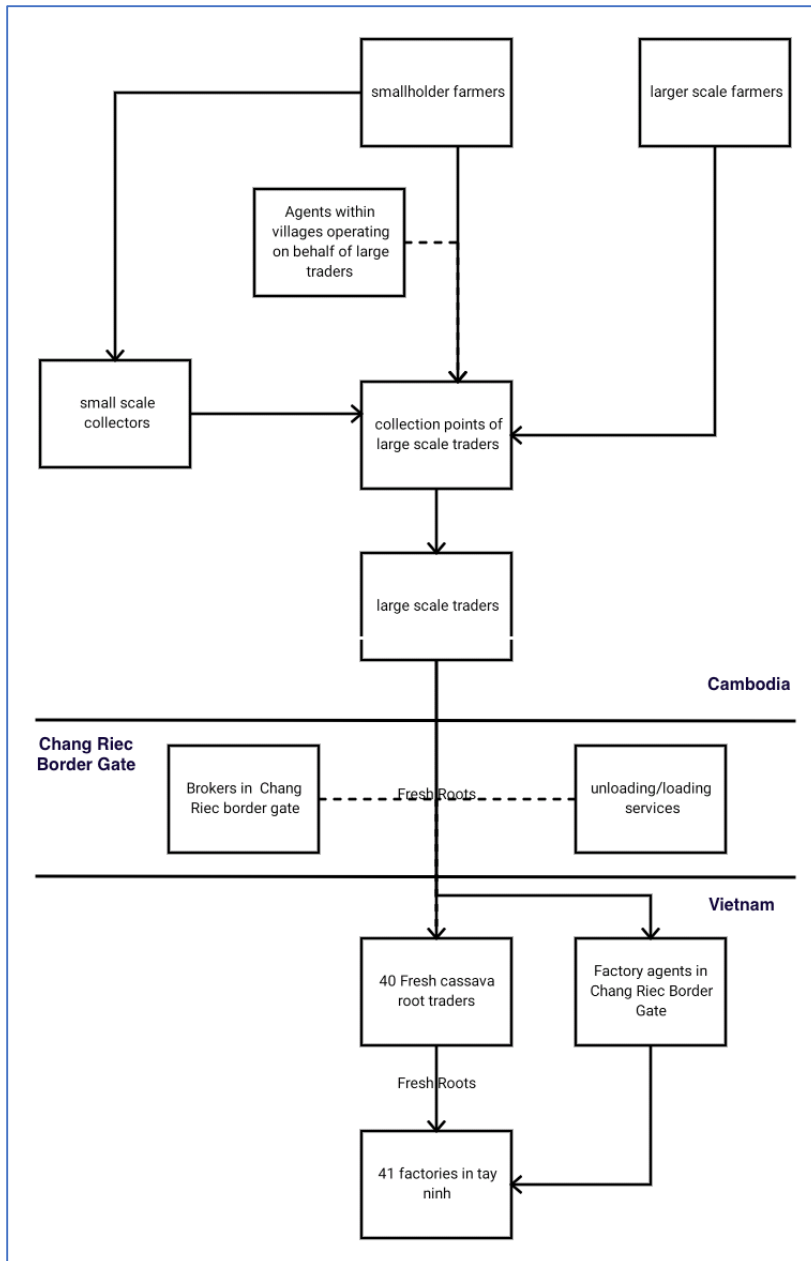


Figure 4: Representation of fresh cassava root value chain from Kratie province

Small scale farmers producing cassava in the relatively densely populated regions close to Kratie town mostly sell fresh roots to large scale traders through a network of agents operating at village level. The agents pay farmer upon delivery of fresh root to small collection points inside the village and then organize for the large trader to collect from the small collection points and transfer to larger collection points or directly to the border.

In the less densely populated areas to the South East of Kratie town and in Snoul district, small scale farmers sell cassava directly in their fields to small scale collectors who also supply labour to load cassava onto trucks. These smaller scale collectors then transport fresh roots to a network of collection points owned by large traders. The collection points are located along the major roads within the province, especially on Road 7 between Kratie and Snoul.



Larger scale farmers generally transport fresh root directly to the collection points using their own labour and transportation equipment, or contract smaller traders to undertake loading, transport and unloading at collection points. Under this arrangement, the small traders do not take ownership of the cassava.

Large traders from both Kratie (including Kratie Town and Snoul District) and Memot town of Tbong Khmum Province are involved in the fresh cassava value chain from Kratie. They use 40 ton trucks to transport fresh roots from the collection points to the Vietnamese border at Chang Riec border gate.

The trade at the border is facilitated by brokers. These brokers operate in the “no-man’s land” between the Cambodian customs point and the Vietnamese customs point. The brokers normally speak both Khmer and Vietnamese, and their function is to link Cambodian sellers and Vietnamese buyers. The brokers do not take ownership of the product, only facilitate the agreement between buyer and seller. Once an agreement is reached between the Cambodian seller and the Vietnamese buyer, the Cambodian seller will come to Cambodian customs and pay the necessary fees and the Vietnamese buyer will do the same with Vietnamese customs. At the border, the fresh roots need to be offloaded from the Cambodian trucks and then reloaded onto Vietnamese trucks.

Cassava roots are either purchased by Vietnamese traders who then transport and sell to factories within Tay Ninh, or directly by factories who maintain collection points and staff at the border gate. Transportation from the border to factories is generally undertaken utilizing 30 ton trucks.

The farmgate price for fresh root in Kratie (April 2017) was the equivalent of around USD50.80 per ton, around 68 percent of the factorygate price in Tay Ninh (USD75.09/ton). While the farmgate price represents a relatively high proportion of the factorygate price, the Cambodian farmers also incur more than 80 percent of the total costs along the value chain.

As shown in Figure 5, the price at the border is more than 80 percent of the factorygate price and almost 65 percent of the total net margin is captured by Cambodian value chain actors. However, Vietnamese traders gain the largest share of net margin (36 percent) of any single actor type along the value chain, followed by Cambodian farmers.

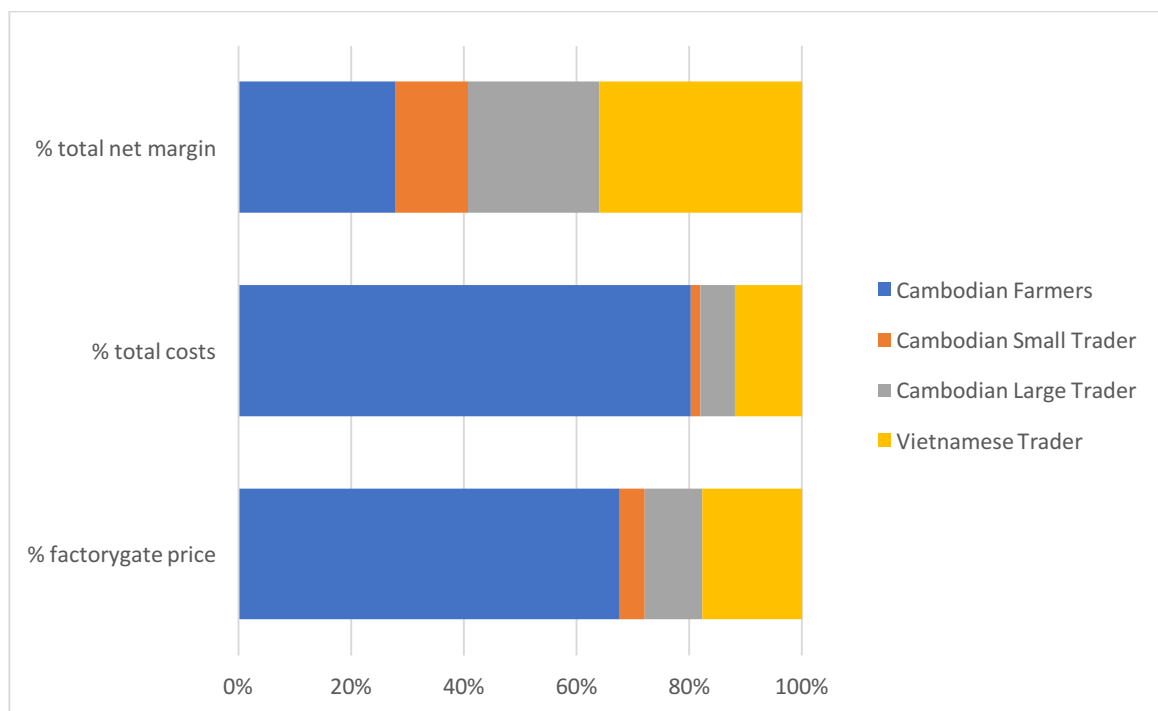


Figure 5: Distribution of net margin, costs and proportion of factorygate price.

The factorygate prices for comparable quality fresh cassava root from Cambodia and from Tay Ninh are the same<sup>6</sup>. The impact of the border costs incurred for cassava from Cambodia mean that the prices for fresh cassava root at the farmgate in Kratie are generally lower than comparable quality fresh cassava root farmgate prices in Tay Ninh.

A reduction in the border costs could potentially result in an increase in the farmgate price of cassava in Kratie. In the current low price/low margin environment this could mean the difference between continuing to plant cassava or shifting to other activities.

As ASEAN economic integration increases through the implementation of the market integration pillar of the ASEAN Economic Community there will be a progressive lowering or removal of customs charges within ASEAN and (in the longer term) a change to allowing cross-border transportation without loading/unloading of trucks. If these costs were eliminated or substantially reduced in the Tay Ninh Border crossing there could be large potential savings, more than equal to the current net margin for cassava famers.

<sup>6</sup> This assumes that other factors are the same, including starch content, proportion of foreign matter and the time of selling.

## Location of Project Activities

### Value Chain Survey Locations

Farmer focus groups and interviews with key value chain actors were carried out in and around three villages in the main cassava production regions within Kratie – Prek Thaham village, Kbal Trach Village and Chror Va Koh Dach Village. Visits were made to Trepream Sre/Te Hoa Lu border gate in Snoul District, on the border with Binh Phuoc province in Vietnam. Field visits were also made in Tay Ninh Province (Vietnam) to Xa Mat and Chang Riec border gates where information was gathered from traders and brokers.

### Household Survey Locations

The household surveys were undertaken in Kratie and Stung Treng provinces. Within Kratie the interviews were conducted in Snuol and Chitr Borie districts, and within Stung Treng they were conducted in Siem Bouk District. The useable sample was more or less divided evenly across the surveyed districts with 100 households in Snuol, 101 in Chitr Borie, and 110 in Siem Bouk.

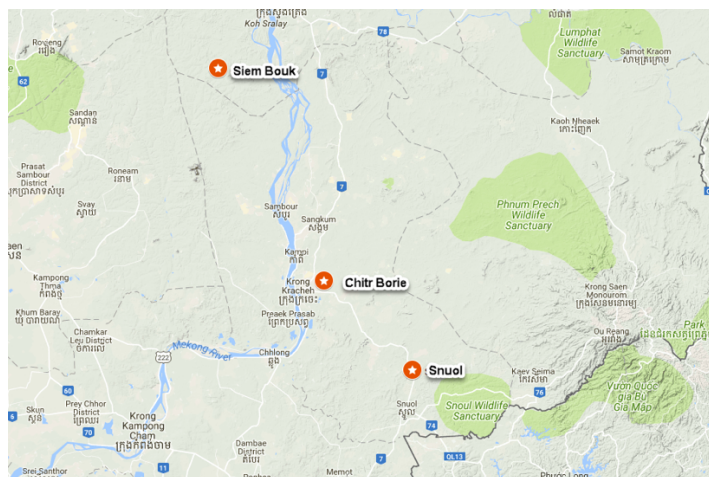


Figure 5: Survey Sites, Cambodia

Table 5: Households by Survey locations – Cambodia

Districts	Number of household surveys
Chitr Borie	101
Siem Bouk	110
Snuol	100
<b>Total</b>	<b>311</b>

Figure 6 shows the distribution of household incomes across the three surveyed districts. While the distribution seems quite even, there is a greater likelihood for a farmer from Chitr Borie to be in a higher income quartile while the opposite is true for farmers from Siem Bouk.

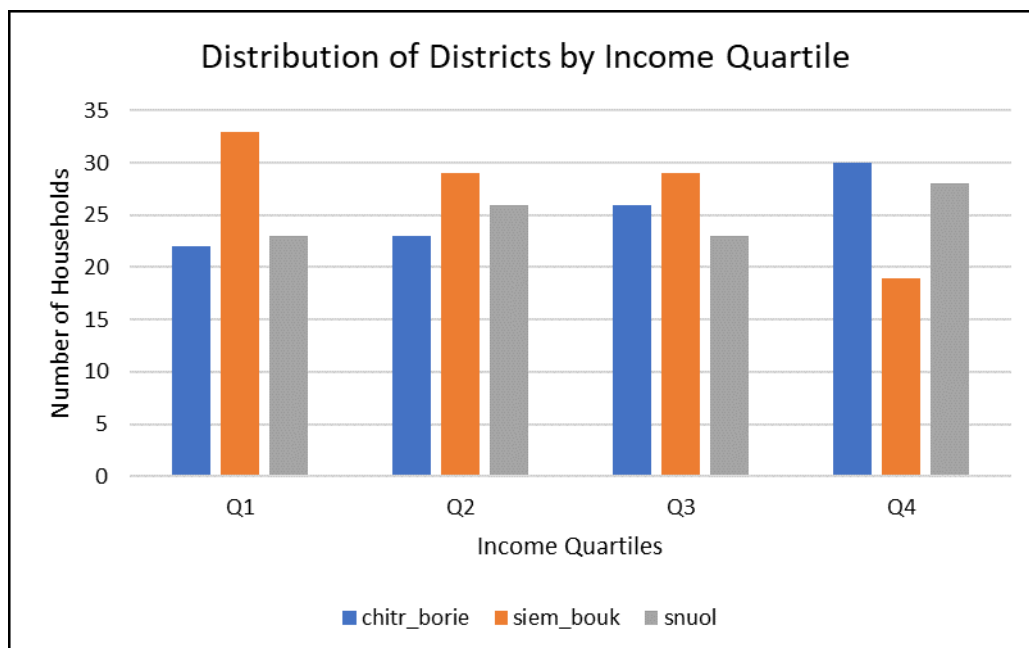


Figure 6: Distribution of districts, by income quartiles

## Livelihood Information

### Time of first cultivating cassava

Adoption of cassava by farmers started gaining popularity in the early 2000s, and spiked in 2007. Since then new adoptions have been relatively consistent although the number of new adopters have dropped significantly in the last few years.

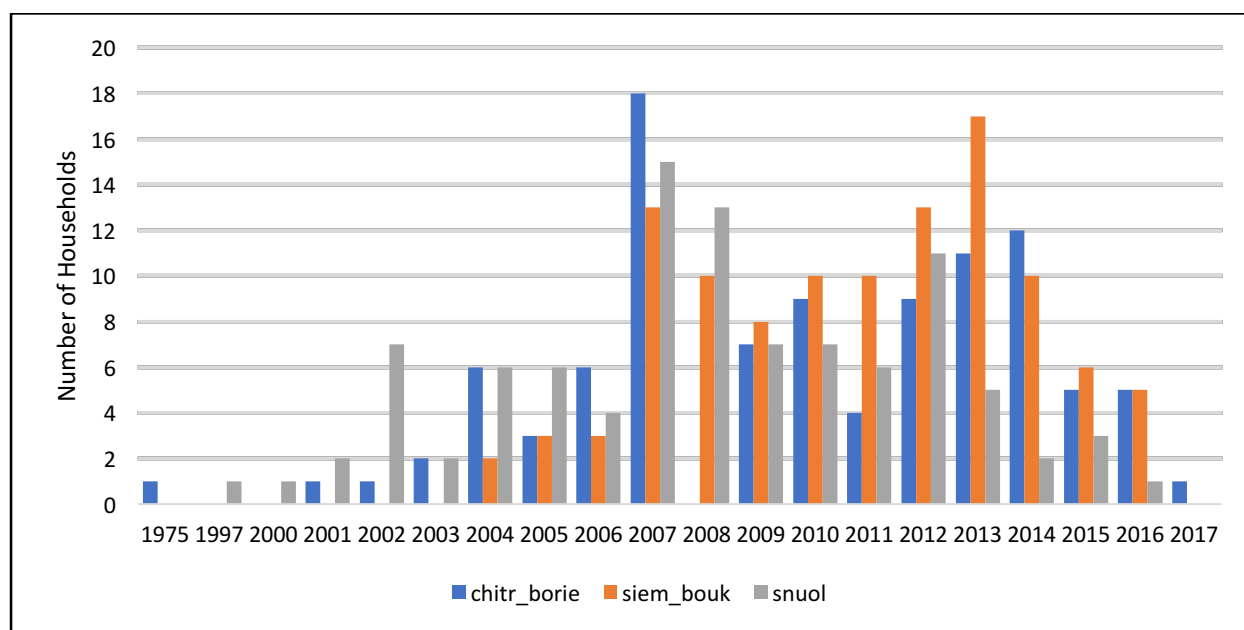


Figure 7: Year of First Cassava Production, by District

## Income from various on-farm and off-farm activities

Across all surveyed districts the most important source of income is cassava production which contributes almost 50% of household income. Off farm income is the second most important source of income with a contribution between 30% to 40% to overall household income. The importance of paddy rice varies across districts with a contribution of almost 10% to overall household income in Chitr Borie while it is a low 1.5% in Siem Bouk. Tree crops on the other hand plays a more significant role in Siem Bouk contributing almost 9% to overall household income while they aren't a very significant source of income for Chitr Borie. Livestock production is not viewed as an income generating source with overall contribution of only 1.7% across all surveyed districts. More information about annual incomes from various sources is given in Figure 8.



Figure 8: Source of Income, by District

## Importance of Cassava in overall livelihood and in cash income

Across the major sources of income, cassava tops the list with slightly less than 50% contribution to overall household income. Income earned off the farm contributes to slightly above 37% which is followed by other non-cassava crops at about 13% and finally livestock which contributes less than 2% to household income. The importance of the various income sources are relatively consistent across all surveyed districts (Table 2 and Figure 9).

Table 2: Annual Income from different sources, by district

District	Chitr Borie	Siem Bouk	Snuol	Total
Cassava Income	5,892,117.82	5,971,988.27	8,033,724.00	6,608,987.17
Non-Cassava Cropping Income	1,244,371.29	1,498,886.36	2,619,500.00	1,776,556.27
Total Livestock Income	330,544.55	118,809.09	263,300.00	234,032.15
Off-farm Income	4,776,621.78	5,149,511.82	5,425,750.00	5,117,235.05

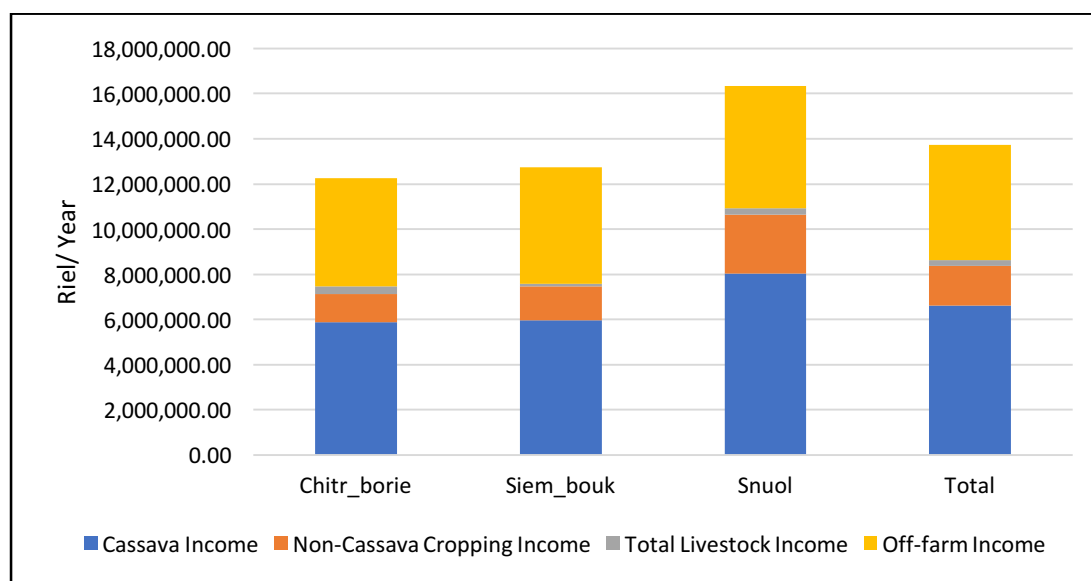


Figure 9: Income Sources, by District

The contribution of cassava to overall household income is relatively consistent across all income quartiles, although its importance seems to be slightly lower in the higher income groups. While there is not much difference across income groups regarding the source of income, higher income groups tend to have a slightly higher portion of their income coming from off farm sources relative to low income groups (Table 3 and Figure 10).

Table 3: Annual Income from different sources, by income quartile

Income Quartiles	Q1	Q2	Q3	Q4	Total
Cassava Income	1,485,012.18	3,368,543.59	6,038,280.00	15,660,153.51	6,608,987.17
Non-Cassava Cropping Income	436,628.21	1,078,730.77	1,688,025.64	3,930,454.55	1,776,556.27
Total Livestock Income	47,500.00	112,948.72	309,230.77	469,467.53	234,032.15
Off-farm Income	935,208.97	1,833,074.36	4,361,525.64	13,445,909.09	5,117,235.05

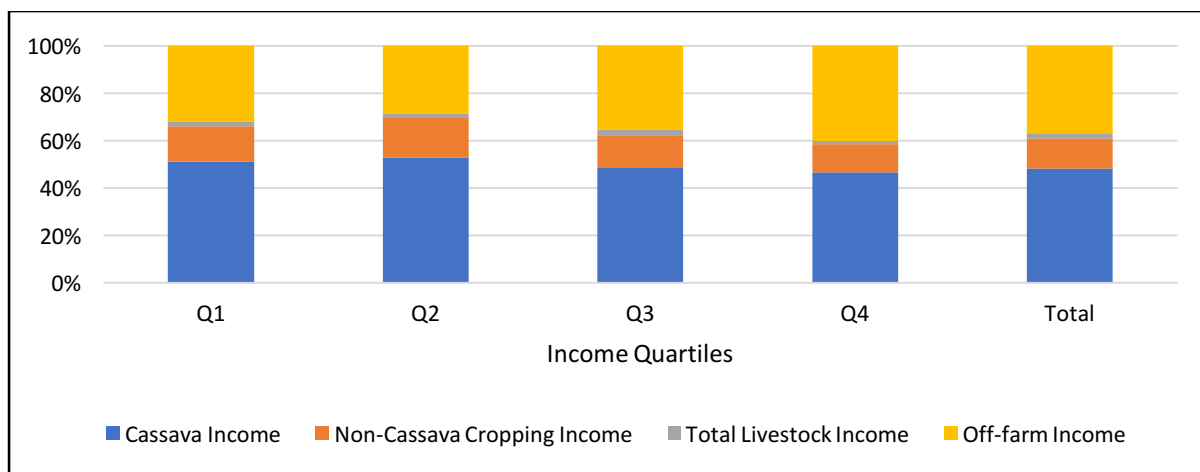


Figure 10: Sources of Livelihood, by Income Quartile

Figure 11 shows the sources of cash income by income quartile. This is derived by not including the value of the staple crop (paddy or upland rice) in the calculation of gross income. The figure further highlights the importance of cassava as a source of cash income particularly to the lower income households where its contribution increases to almost 60% of overall household income. Cassava remains a dominant source of household income even for the wealthiest quartile supplying close to 50% of their household cash income.

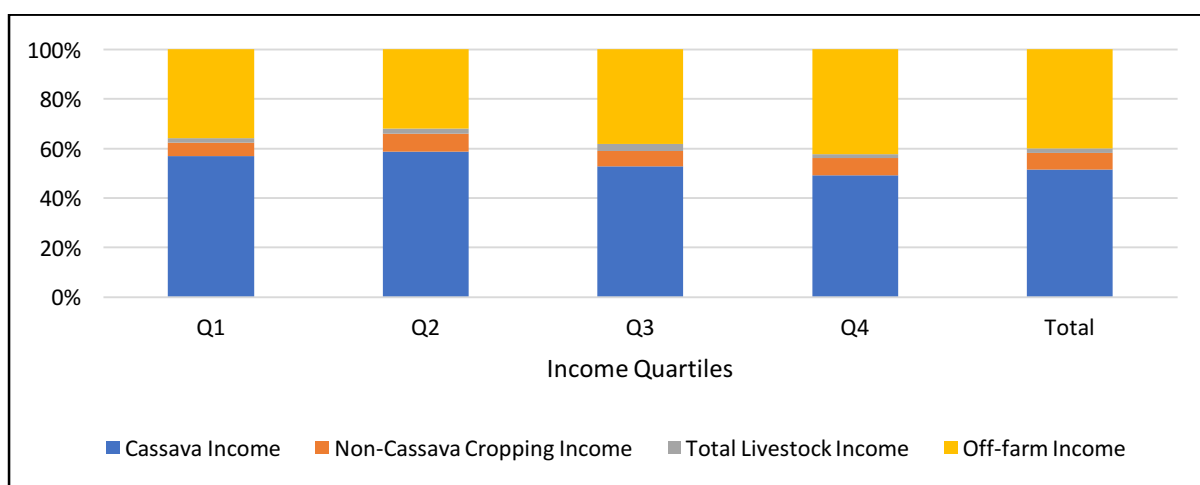


Figure 11: Cash Income Source, by Income Quartile

## Labour Force

Across all surveyed districts, the average household size was 4.69. While an average of 1.87 household members were full time agricultural workers, an average of 2.91 members had at least some involvement in agriculture. This implies that about 40% of household members have no involvement in agriculture. The proportion of household members working off farm corresponds well with the proportion of income that come from off-farm sources which is also close to 40%.

Table 4: Family member numbers by employment status in agriculture

Employment status in Agriculture	Average Number of Family Members		
	Females	Males	Total
Full time	0.77	1.10	1.87
Never	0.93	0.85	1.78
Part time	0.30	0.22	0.52
Rarely	0.33	0.18	0.52
<b>Total</b>	<b>2.33</b>	<b>2.36</b>	<b>4.69</b>

### Use of labour by gender and household/non-household

Most activities related to cassava production do not seem to have specific gender roles although overall men are more involved in all cassava related activities, except for field establishment, chipping and drying and other post-harvest work. Men do however have a dominant role in activities involving pest and disease control and transportation (Figure 12).

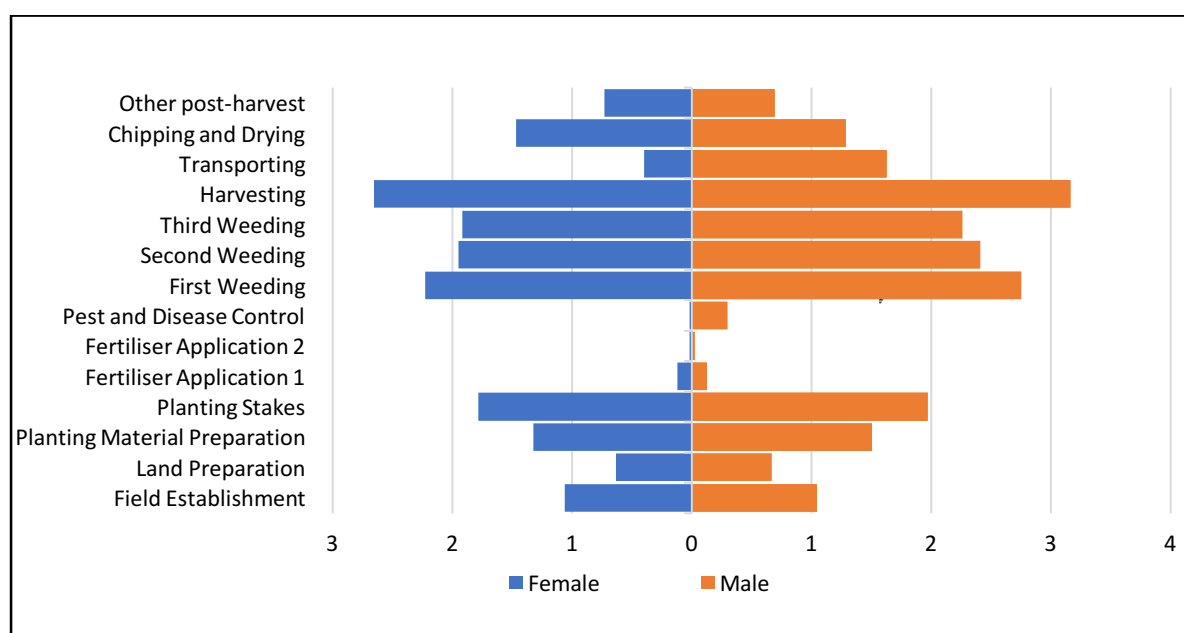


Figure 12: Household Labour Person-Days per hectare, by Gender

Household labour is utilized more than outside labour for most agricultural activities related to cassava production. However, for certain undertakings such as planting stakes, transportation and harvesting, outside labour is sought by households. Particularly for transportation and harvesting, outside labour employed is often 4 to 5 times higher than that provided from within the household.



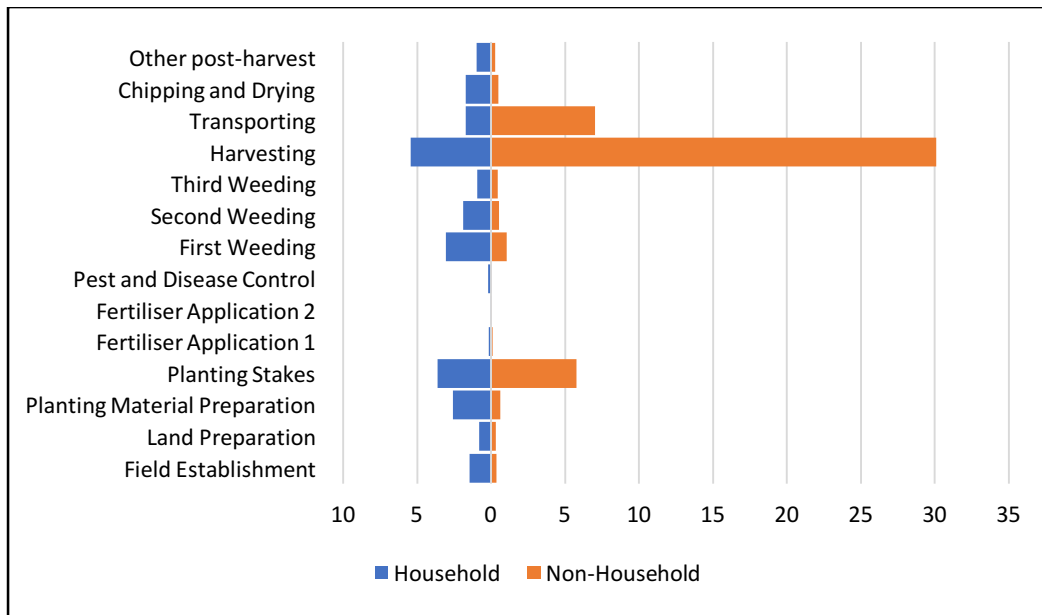


Figure 13: Labour Person-Days per hectare, by Source

## Access to credit

Slightly over 40% of households had taken a loan in the past 12 months, with a majority of them having taken out only a single loan. Households in the highest income group were almost twice as likely to have taken a loan compared to those in the lowest income groups. The total value of loan of the highest income quartile was over four times that of the lowest income quartile (Table 5).

Table 5: Proportion of households having taken loans

Access to Credit	Q1	Q2	Q3	Q4	Total
Percent of households that received a loan in the past 12 months	30.77%	30.77%	44.87%	57.14%	40.84%
% households with 1 loan	25.64%	24.36%	42.31%	51.95%	36.01%
% households with 2 loans	2.56%	5.13%	2.56%	5.19%	3.86%
% households with 3 loans	2.56%	1.28%	0.00%	0.00%	0.96%
Average value of total loans received (Riel)	4,437,500	7,305,208	7,171,428	18,335,909	10,548,070

Of those surveyed 71% indicated that their level of debt was either 'manageable' or 'very manageable' while the remaining respondents seemed to have at least some concerns. As shown in Table 6, slightly under 25% reported 'some concern' while about 4% said their level of debt was 'worrying'.

Table 6: Manageability of debt

How manageable is the current level of debt	Frequency	Percent
Worrying	6	4.35%
Some concern	34	24.64%
Manageable	72	52.17%
Very manageable	26	18.84%
<b>Total</b>	<b>138</b>	<b>100.00%</b>

## Access to information

The most common source of information on agricultural production was through ‘friends and neighbours within the village’ which was closely followed by ‘family’ members. Beyond these two primary sources, only a few respondents indicated other options available for receiving information on agricultural production. Some sources of information reported by a handful of households were ‘farmer groups’, ‘cassava traders’ and ‘government extension staff’.

Table 7: Sources of information on agricultural production

Source of Information	Frequency	Percentage
Friends and neighbours in the village	229	73.63%
Family	225	72.35%
Farmer Group	13	4.18%
Cassava Traders	13	4.18%
Province government extension staff	11	3.54%
Friends and neighbours outside the village	8	2.57%
Non Government Organizations	8	2.57%
Radio	7	2.25%
Other	6	1.93%
District government extension	3	0.96%
Researchers	3	0.96%
TV	2	0.64%
Cassava Processors	1	0.32%
Internet	0	0.00%

‘Cassava traders’ were identified as the primary source of information on agricultural markets by a majority (95%) of respondents. This was followed by ‘friends and neighbours in the village’ (17%) and ‘family’ (5%). The role of government extension programs for marketing information on the other hand was almost non-existent.

Table 8: Sources of information on agricultural markets

Source of Information	Frequency	Percentage
Cassava Traders	296	95.18%
Friends and neighbours in the village	52	16.72%
Family	16	5.14%
Farmer group	13	4.18%
Cassava processors	10	3.22%
Friends and neighbours outside the village	3	0.96%
Radio	3	0.96%
Province government extension staff	2	0.64%
Other	2	0.64%
Non government organisation	1	0.32%
Internet	1	0.32%
District government extension	0	0.00%
Researchers	0	0.00%
TV	0	0.00%

## Group membership

Only eight households (2.57% of all households) indicated that they had a household member participating in a group or a mass organization. All eight of them were involved with a single organization.

## Ownership of assets

The mode of transportation used by most farmers is a motorbike. The proportion of households owning a motorbike is over 92% with ownership relatively even across all income quartiles. Owning a car is extremely rare, instead a handful of farmers (8%) in the fourth quartile own trucks. Ownership of four wheel tractors are more common in relation to two wheel tractors. On average 12% of farmers own two wheel tractors while the likelihood of owning such a tractor is higher for the higher income groups. Mobile phone ownership is quite high (84%) and relatively even across the income groups although the likelihood of owning a smartphone is higher for farmers in the higher income groups.

Table 9: Asset ownership by income quartile

Assets	Q1	Q2	Q3	Q4	Total
truck	0.00%	0.00%	3.85%	7.79%	2.89%
car	0.00%	2.56%	0.06%	2.60%	1.29%
motorbike	87.18%	94.87%	93.59%	94.81%	92.60%
lot sing	17.95%	30.77%	42.31%	40.26%	32.80%
two wheel tractor	1.28%	1.28%	2.56%	3.90%	2.25%
four wheel tractor	5.13%	15.38%	8.97%	19.48%	12.22%
water pump	6.41%	6.41%	12.82%	12.99%	9.65%
generator	1.28%	1.28%	5.13%	5.19%	3.22%
mobile phone	84.62%	78.21%	88.46%	84.42%	83.92%
smart phone	12.82%	20.51%	15.38%	28.57%	19.29%
tv	26.92%	29.49%	30.77%	50.65%	34.41%
dvd player	12.82%	11.54%	10.26%	14.29%	12.22%
radio	24.36%	25.64%	26.92%	25.97%	25.72%
refrigerator	0.00%	1.28%	0.06%	0.14%	0.32%

## Agronomic Information

### Area, production, Current yields and trends

The average cassava production area per household is 2.82 hectares, varying between 2.54 hectares in Siem Bouk and 3.16 hectares in Snuol. Average production is about 31 tons, giving a yield of about 11 tons per hectare (Table 10). The yield per hectare was relatively consistent across the different districts and only ranged between 10.6 tons in Chitr Borie to 11.8 tons in Siem Bouk.

Table 10: Household cassava production characteristics, by district

District	Chitr Borie	Siem Bouk	Snuol	Total
Cassava production 2016 (tons)	30	30.1	34.3	31.6
Cassava Harvest Area 2016 (ha)	2.78	2.54	3.16	2.82
Cassava Yield 2016 (t/ha)	10.6	11.8	10.8	11.1

### Varieties

The most common varieties reported by farmers were Truoy svay (Malay) and Truoy sor, together accounting for the varieties used by almost 80 percent of farmers.

Table 11: Household cassava production characteristics, by district

Variety	Frequency	Percent
Truoy svay (Malay)	221	51.88%
Truoy sor	117	27.46%
Other	88	20.66%
<b>Total</b>	<b>426</b>	<b>100.00%</b>

Both varieties were introduced in the early 2000s, but Truoy svay (Malay) was initially the more popular. In recent years the popularity of Truoy svay (Malay) has declined, while there has been an increase in adoption of Truoy sor starting in 2014.

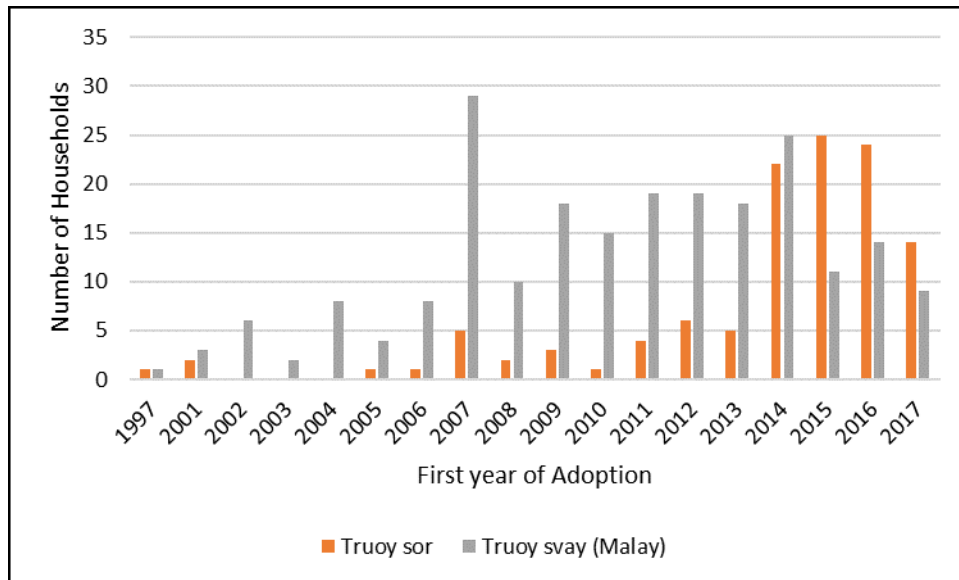


Figure 14: First year of adoption, by variety

## Highest and lowest yields

The average highest cassava yield in the past five years across all districts was almost 17 tons per hectare, with Snuol leading the rest of the districts with 18.5 tons per hectare. The average lowest yield in the past five years on the other hand was only 8.7 tons per hectare. Overall the amount of land dedicated to cassava production as well as yield trends are similar across the three surveyed districts.

Table 12: Highest and Lowest Production in last 5 years, by district

District	Chitr Borie	Siem Bouk	Snuol	Total
Highest Cassava Production in the last five years (t)	32.40	32.30	42.04	35.45
Area Utilized for Highest Cassava Yield in the last five years (ha)	2.13	2.14	2.32	2.19
Highest Cassava Yield in the last five years (t/ha)	15.57	16.74	18.52	16.93
Lowest Cassava Production in the last five years (t)	19.35	18.11	25.13	20.77
Area Utilized for Lowest Cassava Yield in the last five years (ha)	2.34	2.23	2.7	2.41
Lowest Cassava Yield in the last five years (t/ha)	8.17	8.79	9.14	8.70

Cassava yields are reported to be declining either rapidly or moderately for about 74% of farmers across all districts. The rate of decline in cassava performance is relatively even across the three districts. On the contrary about 15% of farmers across all districts reported increasing cassava yields with almost 20% of farmers in Chitr Borie reporting such an increase.

Table 13: Yield Trends, by district

District	Chitr Borie	Siem Bouk	Snuol	Total
Declining rapidly	36.73%	27.78%	29.59%	31.25%
Declining moderately	34.69%	46.30%	45.92%	42.43%
fluctuating, but no clear trend	0.00%	1.85%	1.02%	0.99%
Relatively constant	9.18%	10.19%	11.22%	10.20%
Increasing	19.39%	12.96%	12.24%	14.80%
Increasing rapidly	0.00%	0.93%	0.00%	0.33%

## Plans for growing cassava in the future

Slightly over 37% of farmers surveyed indicated that they intended to plant cassava into the future. However a higher portion of farmers, 40% stated that they would not be growing cassava in the future. Farmers in Siem Bouk indicated the lowest likelihood of planting cassava in the future cassava, as well as the highest likelihood of not planting in the future. However, intentions for future cassava production are not particularly indicative of the income status of the farmers and instead quite uniform across all income quartiles (Table 14 and Table 15).

The intent of many farmers to cease cassava production in the future corroborates with their declining cassava yields. These intentions regarding future production are concerning given that up to 60% of household cash income is from cassava production.

Table 14: Future production intention, by district

Will you grow Cassava in the Future?	Chitr Borie	Siem Bouk	Snuol	Total
Yes	40.59%	27.27%	45.00%	37.30%
No	20.79%	54.55%	44.00%	40.19%
Unsure	38.61%	18.18%	11.00%	22.51%

Table 15: Future production intention, by income quartile

Will you grow Cassava in the Future?	Q1	Q2	Q3	Q4	Total
Yes	42.31%	35.90%	32.05%	38.96%	37.30%
No	35.90%	41.03%	47.44%	36.36%	40.19%
Unsure	21.79%	23.08%	20.51%	24.68%	22.51%

## Soil Erosion Problems and Control Techniques

Almost 66% of cassava farmers viewed soil erosion as a problem although this perception ranged from a high of 74% of farmers in Chitr Borie to a low of about 55% in Siem Bouk. Almost 27% of farmers in Chitr Borie reported soil erosion to be a ‘serious’ or even a ‘very serious problem’. Despite the severity of soil erosion, only 13% of all farmers were aware of any measures to reduce soil erosion. The level of awareness is somewhat related to the severity of the problem with a larger number of farmers (19%) from Chitr Borie indicating awareness of measures to reduce soil erosion. Only a handful of farmers across the surveyed districts (1.6%) had any previous training on soil conservation measures. While a considerable number of farmers (53%) are keen to participate in erosion control measure trials on their land, this is still less than the number of farmers stating problems of soil erosion.

Table 16: Soil erosion perception, by district

Name of district	Chitr Borie	Siem Bouk	Snuol	Total
Soil Erosion perceived as a problem	74.26%	54.55%	70.00%	65.92%
Small Problem	16.83%	19.09%	16.00%	17.36%
Medium Problem	30.69%	24.55%	42.00%	32.15%
Serious Problem	23.76%	10.00%	12.00%	15.11%
Very Serious Problem	2.97%	0.91%	0.00%	1.29%
Are you aware of any measure to reduce soil erosion?	18.81%	12.73%	8.00%	13.18%
Have you had any training on any soil conservation measures?	0.99%	2.73%	1.00%	1.61%
Are you interested in trialling conservation practices on your land?	63.37%	49.09%	47.00%	53.05%

Adoption of intercropping is found to be relatively high with almost 58% of farmers having grown intercrops with cassava and almost 50% currently involved in the practice. Perhaps because a good number of farmers are already adopting this method of cultivation, only about 32% of farmers revealed an interest in trialling intercrops on their lands.

Table 17: Awareness of intercropping, by district

Name of district	Chitr Borie	Siem Bouk	Snuol	Total
Have you ever grown intercrops with your cassava?	36.63%	69.09%	66.00%	57.56%
Do you currently grow any intercrops with your cassava?	26.73%	61.82%	59.00%	49.52%
Are you interested in trialling new intercrops?	40.59%	28.18%	27.00%	31.83%

### Fertiliser adoption, awareness and correct application

Fertilizer application reported by respondents was generally quite low with an average of 1.29% of total stating the use of organic fertilizers and 5.79% using inorganic fertilizers. Furthermore only a handful reported having any knowledge about NPK values related to fertilizers that they used. Despite very low levels of fertilizer use, almost 25% indicated having seen a fertilizer trial on cassava. However this varied across districts with only 17% reporting such participation in Siem Bouk while it was as high as 34% in Snuol. Overall there seems to be a positive attitude towards the use of fertilizers and significant interest from the farmers for learning more about them. Overall 82% expressed their interest in visiting a fertiliser demonstration trial while almost 65% indicated that they would like to conduct such a trial on their own lands.

Table 18: Fertiliser Practice, by district

Name of district	Chitr Borie	Siem Bouk	Snuol	Total
Do you apply organic fertiliser to your cassava?	2.97%	0.00%	1.00%	1.29%
Do you apply inorganic fertiliser to your cassava?	7.92%	4.55%	5.00%	5.79%
Do you understand what the NPK values mean on the fertiliser you apply?	1.98%	0.00%	2.00%	1.29%
Have you ever seen a fertiliser trial on cassava?	22.77%	17.27%	34.00%	24.44%
Are you interested in visiting a fertiliser demonstration trial to see the result on production and returns?	87.13%	70.00%	91.00%	82.32%
Are you interested in conducting a trial on your own land?	75.25%	58.18%	62.00%	64.95%

### Weeds, weeding and herbicide

Almost all farmers (99%) identified weeds as a problem for agricultural production limiting the productivity of their cassava crop. The severity of the problem was emphasized by the farmers where about 75% reported weeds to be a 'large problem' having a large impact upon their cassava production.



Table 19: Weed Impact Perception, by district

Do you think that weeds limit the productivity of your cassava crop?	Chitr Borie	Siem Bouk	Snuol	Total
large problem	74.26%	72.73%	76.00%	74.28%
medium problem	15.84%	15.45%	10.00%	13.83%
Small problem	7.92%	10.91%	14.00%	10.93%
No Problem	1.98%	0.00%	0.00%	0.64%

While almost all farmers are aware of the severity of the weed problem, it appears that they are also committed to controlling them. Almost 97% of farmers indicated using herbicides to control weeds on their farms. However, adequate farmer training for proper herbicide use is still lacking across all districts. On average only about 15% of farmers claim to have received any training on herbicide use with only 30% using protective clothing during its application. Of the three districts, farmers from Chitr Borie had the least amount of training on herbicide use and also were least likely to be practicing precautionary measures during herbicide application.

Table 20: Herbicide Practice, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Do you apply any herbicides?	95.05%	97.28%	98.00%	96.79%
Have you received any training on herbicide use?	7.92%	17.27%	19.00%	14.79%
Do you use protective clothing when applying herbicide?	16.83%	40.00%	34.00%	30.55%

In addition to herbicide use manual weeding is also a popular method of controlling weeds with over 67% claiming to have employed such methods. Conducting up to three rounds of weeding is quite common although there are a handful that also conduct a fourth round (Table 21).

Table 21: Manual Weeding Practice, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Do you conduct manual weeding?	82.18%	53.64%	67.00%	67.20%
1 weeding	23.76%	15.45%	22.00%	20.26%
2 weedings	19.80%	20.00%	16.00%	18.65%
3 weedings	31.68%	14.55%	23.00%	22.83%
4 weedings	4.95%	3.64%	4.00%	4.18%
5 weedings	0.99%	0.00%	0.00%	0.32%

## Land Preparation

Almost 90% of farmers utilize either 2 or 4 wheel tractors to cultivate their cassava fields although there is some variation in terms of employment of tractors across the three

districts. Compared to over 95% of tractor use for land cultivation in Chitr Borie and Snuol, only about 65% of farmers in Siem Bouk employ them for land cultivation. Employing manual tools on the other hand is more popular in Siem Bouk than in the other two districts. A stark contrast in terms of land cultivation across the three districts was found with regards to the creation of ridges. On average about 40% of farmers make ridges, however this method is extremely popular in Chitr Borie with over 86% of farmers employing them while in Siem Bouk less than 2% have taken up this practice.

Table 22: Land Cultivation Practice, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Tractor	5.94%	3.64%	2.00%	3.86%
4 wheel tractor	97.03%	62.73%	96.00%	84.57%
Buffalo or cattle	0.00%	0.00%	0.00%	0.00%
Manual Tools	0.00%	20.91%	2.00%	8.04%
Make Ridges	86.14%	1.82%	37.00%	40.51%
Dibble	0.00%	9.09%	0.00%	3.22%

## Cassava Utilization

Almost 82% of farmers across all districts sold fresh cassava while only about 30% sold dry chips. The preference for selling fresh cassava over dried chips was particularly pronounced in Snuol where 91% sold fresh cassava and only 16% were involved in selling dried chips. This division across fresh vs. dried cassava was more even for Siem Bouk where 67% of farmers sold fresh cassava while 50% also sold dried chips. Almost all of the cassava grown were sold in one form or another with hardly any household use for the crop (Table 23).

Table 23: Cassava Utilization, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Eat	0.99%	0.00%	1.00%	0.64%
Use for own livestock	0.00%	0.00%	0.00%	0.00%
Cassava Leaf	0.00%	0.00%	0.00%	0.00%
Sell fresh cassava	89.11%	67.27%	91.00%	81.99%
Sell Dried cassava	20.79%	50.00%	16.00%	29.58%

## Relationship with Traders

Of farmers that sold cassava to fresh root traders, about 23% described their relationship with traders as strong or very strong, while about the same fraction, 24%, regarded the relationship to be weak or very weak. Over 50% considered their relationships to be moderate.

There were fewer farmers involved in selling dried chips, but overall the relationship with their traders seemed to be slightly better (Table 24 and Table 25).

Table 24: Relationship with fresh root traders, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Very Strong	0.00%	1.35%	0.00%	0.39%
Strong	33.71%	24.32%	10.99%	22.83%
Moderate	55.06%	48.65%	52.75%	52.36%
Weak	4.49%	13.51%	30.77%	16.54%
Very Weak	6.74%	12.16%	5.49%	7.87%

Table 25: Relationship with dry chip traders, by district

Name of District	Chitr Borie	Siem Bouk	Snuol	Total
Very Strong	0.00%	3.64%	0.00%	2.17%
Strong	33.33%	27.27%	31.25%	29.35%
Moderate	57.14%	47.27%	37.50%	47.83%
Weak	0.00%	10.91%	12.50%	8.70%
Very Weak	9.52%	10.91%	18.75%	11.96%

## Trials 2016-2017

Variety trials in Cambodia aim to evaluate the improved cassava varieties to obtain the best adopted varieties in order to improve cassava production systems in Kratie. Varieties evaluated are:

1. Rayong 72(Thai variety)
2. Huay Bong 60 (Thai variety)
3. KM98-1 (Vietnam variety)
4. KU50 (Thai variety)
5. SC 9 (China variety)
6. SC8 (China variety)
7. Local variety

Fertilizer trials in Cambodia involve a split-plot design with 3 Replications with 7 treatments and 1 variety (KU50). The objective is to study the response of KU50 to the application of various combinations of fertilizers (N, P and K) in order to find the best and most economic fertilizer rate to obtain and maintain high cassava yields.

Intercropping trials in Cambodia aim to study the different legume intercrops with cassava to find the best and most economic option for farmers in Kratie province. The trial is being conducted at two sites and has three replications and four treatments (maize, peanut, mung bean, no treatment).

## Future plans and partnerships

Action plan for 2018 is based on experience from 2017, the current situation in Kratie, and takes into account the small size of the CARDI team.

In 2016-2017 the team undertook value chain analyses, household surveys, variety trials, fertility trials and intercropping trials.

In 2018, the team intends to proceed with the following:

Intercropping trials will be discontinued and the demonstration plots will be used for experimenting with cassava varieties and fertiliser treatments. These demonstrations will be undertaken on land rented by the project. The number of cassava variety and fertiliser trials will also be reduced to more manageable levels. Fertilizer trials will be reduced and so will cassava varieties to between two and three per demonstration field. For the field demonstrations, the land preparation process will be mechanized and effort will be made to increase the involvement of local authorities (including village heads and extension workers) and traders.

The current recommendations of the project team are the following:

The project should provide more disease tolerant varieties to trial in the future. There should also be a greater emphasis on disease awareness through farmer and trader training programs. The demonstration activities should be moved to different communes in Kratie and also expanded to Tbong Khmum and Stung Treng provinces. Finally, value chain analysis and household surveys should be expanded onto the North West.

## Detailed Tables

Table 26: Average Household Incomes from various sources (Riel/Year), by district

Average Household Incomes from various Sources (RIEL/year)				
District	Chitr Borie	Siem Bouk	Snuol	Total
Cassava Income	5,892,117.82	5,971,988.27	8,033,724.00	6,608,987.17
Paddy rice production value	1,151,821.78	191,090.91	1,316,300.00	864,900.32
Paddy rice sale value	388,514.85	41,454.55	131,900.00	183,247.59
upland rice production value	34,752.48	44,727.27	34,200.00	38,102.89
upland rice sale value	4,950.50	18,181.82	0.00	8,038.59
Income from Maize	0.00	381.82	0.00	135.05
Income from all other annual crops	25,990.10	168,068.18	262,000.00	152,130.23
Income from coffee	0.00	0.00	0.00	0.00
Income from all other tree crops	31,806.93	1,094,618.18	1,007,000.00	721,287.78
Cropping Income	7,136,489.11	7,470,874.64	10,653,224.00	8,385,543.44
Non-Cassava Cropping Income	1,244,371.29	1,498,886.36	2,619,500.00	1,776,556.27
Cattle Income	243,811.88	77,272.73	239,000.00	183,360.13
Buffalo Income	0.00	0.00	0.00	0.00
Goat Income	0.00	0.00	0.00	0.00
Pig Income	9,207.92	8,181.82	0.00	5,884.24
Chicken Income	66,039.60	28,809.09	21,200.00	38,453.38
Duck Income	3,960.40	4,545.45	3,100.00	3,890.68
Other Livestock Income	0.00	0.00	0.00	0.00
fish Income	7,524.75	0.00	0.00	2,443.73
Total Livestock Income	330,544.55	118,809.09	263,300.00	234,032.15
On-farm Income	7,467,033.66	7,589,683.73	10,916,524.00	8,619,575.59
Off-farm Wages	1,175,435.64	1,346,150.00	739,650.00	1,095,692.93
Irregular non-farm income	281,188.12	392,727.27	146,000.00	277,170.42
Salary Income	779,809.90	74,634.55	77,900.00	304,696.46
Remittance Income	917,227.72	289,000.00	157,050.00	450,594.86
NTFP income	0.00	137,727.27	72,900.00	72,154.34
Timber income	1,239,039.60	0.00	60,000.00	421,681.67
Fishing Income	0.00	42,072.73	52,650.00	31,810.29
All other Income	383,920.79	2,867,200.00	4,119,600.00	2,463,434.08
Off-farm Income	4,776,621.78	5,149,511.82	5,425,750.00	5,117,235.05
Total Income	12,243,655.45	12,739,195.55	16,342,274.00	13,736,810.64

Table 27: Average Household Incomes from various sources (Riel/Year), by income quartile

Average Household Incomes from various Sources (RIEL/year)					
Income Quartiles	Q1	Q2	Q3	Q4	Total
Cassava Income	1,485,012.18	3,368,543.59	6,038,280.00	15,660,153.51	6,608,987.17
Paddy rice production value	295,102.56	662,500.00	910,589.74	1,600,844.16	864,900.32
Paddy rice sale value	48,717.95	95,384.62	201,923.08	389,610.39	183,247.59
upland rice production value	0.00	0.00	65,769.23	87,272.73	38,102.89
upland rice sale value	0.00	0.00	25,641.03	6,493.51	8,038.59
Income from Maize	538.46	0.00	0.00	0.00	135.05
Income from all other annual crops	18,750.00	106,089.74	180,769.23	304,870.13	152,130.23
Income from coffee	0.00	0.00	0.00	0.00	0.00
Income from all other tree crops	122,237.18	310,141.03	530,897.44	1,937,467.53	721,287.78
Cropping Income	1,921,640.38	4,447,274.36	7,726,305.64	19,590,608.05	8,385,543.44
Non-Cassava Cropping Income	436,628.21	1,078,730.77	1,688,025.64	3,930,454.55	1,776,556.27
Cattle Income	0.00	39,102.56	274,358.97	423,051.95	183,360.13
Buffalo Income	0.00	0.00	0.00	0.00	0.00
Goat Income	0.00	0.00	0.00	0.00	0.00
Pig Income	2,564.10	14,743.59	0.00	6,233.77	5,884.24
Chicken Income	33,910.26	52,692.31	33,461.54	33,688.31	38,453.38
Duck Income	1,282.05	6,410.26	1,410.26	6,493.51	3,890.68
Other Livestock Income	0.00	0.00	0.00	0.00	0.00
fish Income	9,743.59	0.00	0.00	0.00	2,443.73
Total Livestock Income	47,500.00	112,948.72	309,230.77	469,467.53	234,032.15
On-farm Income	1,969,140.38	4,560,223.08	8,035,536.41	20,060,075.58	8,619,575.59
Off-farm Wages	642,519.23	994,935.90	1,661,397.44	1,083,766.23	1,095,692.93
Irregular non-farm income	67,307.69	151,410.26	583,333.33	307,012.99	277,170.42
Salary Income	27,010.26	61.54	140,384.62	1,061,025.97	304,696.46
Remittance Income	104,166.67	282,500.00	628,910.26	791,168.83	450,594.86
NTFP income	0.00	0.00	287,692.31	0.00	72,154.34
Timber income	60,256.41	156,410.26	374,397.44	1,104,415.58	421,681.67
Fishing Income	12,923.08	320.51	50,000.00	64,415.58	31,810.29
All other Income	21,025.64	247,435.90	635,410.26	9,034,103.90	2,463,434.08
Off-farm Income	935,208.97	1,833,074.36	4,361,525.64	13,445,909.09	5,117,235.05
Total Income	2,904,349.36	6,393,297.44	12,397,062.05	33,505,984.68	13,736,810.64

Table 28: Labour costs for various production activities (KIP/Year), by district

Name of District	chitr_borie	siem_bouk	snuol	Total
Field Establishment Household Labour	13,662.28	42,836.09	29,037.76	28,924.87
Field Establishment Outside Labour	11,091.28	7,392.56	2,931.62	7,159.37
Land Preparation Household Labour	7,203.21	18,589.33	23,284.53	16,401.30
Land Preparation Outside Labour	4,745.98	6,826.91	8,750.07	6,769.49
Planting Material Preparation Household Labour	62,976.63	48,148.69	45,019.62	51,958.06
Planting Material Preparation Outside Labour	15,650.15	6,934.34	14,280.04	12,126.84
Planting Stakes Household Labour	87,108.43	58,116.21	74,086.74	72,666.91
Planting Stakes Outside Labour	113,929.96	106,872.87	127,370.33	115,755.55
Fertiliser Application 1 Household Labour	3,164.11	2,348.48	3,181.82	2,881.32
Fertiliser Application 1 Outside Labour	3,432.34	863.64	1,833.33	2,009.65
Fertiliser Application 2 Household Labour	396.04	363.64	600.00	450.16
Fertiliser Application 2 Outside Labour	0.00	0.00	900.00	289.39
Pest and Disease Control Household Labour	2,993.80	5,470.80	7,597.86	5,350.31
Pest and Disease Control Outside Labour	1,374.60	272.73	1,560.00	1,044.48
First Weeding Household Labour	90,236.45	33,423.72	62,988.68	61,380.57
First Weeding Outside Labour	33,600.21	7,200.00	23,756.10	21,097.21
Second Weeding Household Labour	49,648.07	19,786.65	45,221.62	37,662.86
Second Weeding Outside Labour	24,511.34	2,712.12	6,316.67	10,950.63
Third Weeding Household Labour	28,985.82	9,185.19	18,023.84	18,457.63
Third Weeding Outside Labour	18,847.74	3,787.88	4,221.43	8,818.11
Harvesting Household Labour	192,433.91	169,538.22	125,888.85	162,938.63
Harvesting Outside Labour	441,972.89	1,428,712.15	790,501.92	903,047.56
Transporting Household Labour	54,286.07	24,058.00	25,151.19	34,226.34
Transporting Outside Labour	122,233.57	142,556.55	156,665.15	140,493.01
Chipping and Drying Household Labour				
Chipping and Drying Outside Labour				
Other post-harvest Household Labour	27,768.17	16,602.52	13,454.60	19,216.47
Other post-harvest Outside Labour	8,273.37	6,604.22	430.77	5,161.26
Total Labour				
Household Labour				
Outside Labour				