
CASSAVA PROGRAM DISCUSSION PAPERS

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Smallholder Farmer experience with Cassava related pests and diseases and their view on clean/ certified planting materials¹

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Introduction

The recent boom in the global market for cassava has created livelihood opportunities for many smallholders in Southeast Asia. Research over many years by public agencies has generated an abundance of technologies that could enhance the productivity and sustainability of these cassava producers. While national government policies have not prioritised the dissemination of these technologies, we hypothesise that, in particular contexts, private-sector value-chain actors have incentives to invest in the promotion of suitable varieties, fertiliser regimes, pest control methods, and other production practices. In other contexts, however, there is little incentive for private-sector involvement, and support from public-sector or non-government actors will be required.

In this paper we examine the smallholder cassava farmer experience with pests and diseases across sites in Indonesia, Vietnam, Laos and Cambodia based on the results of an extensive household survey conducted in 2017. We examine the costs associated with damages caused by various cassava pests and diseases as well as farmer attitudes towards adopting certified planting materials.

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Household Survey Locations

Household surveys in **Sikka, Indonesia** were conducted across four communes, Kangae and Kewa Pante in the lowlands and Koting and Nita in the uplands. As a result of relatively small sample sizes across communes much of the survey data is analysed between lowland communes with a total of 60 households and upland communes with 54 households.

Table 1: Households by Survey locations – Sikka, Indonesia

Communes	Number of household surveys	Region	Total
Kangae	59	Lowland	60
Kewa Pante	1		
Koting	16	Upland	54
Nita	38		
Total	114	Total	114

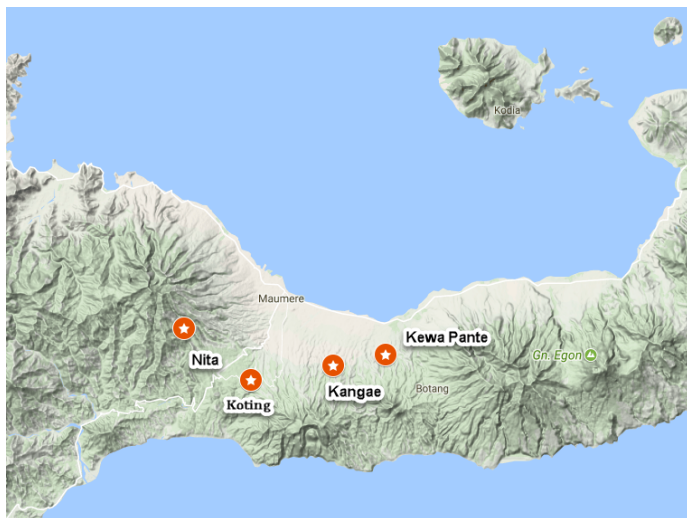


Figure 1: Survey Sites, Sikka, Indonesia

In **North Sumatra, Indonesia** household surveys were conducted in four districts, Papak Bharat, Pematang Siantar, Simalungun and Toba Samosir, with the majority of surveys (over 80%) conducted in Simalungun. The total usable sample size included 138 households.

Table 2: Households by Survey locations – North Sumatra, Indonesia

Districts	Number of household surveys
Simalungun	111
Toba Samosir	17
Pematang Siantar	9

Pakpak Bharat	1
Total	138



Figure 2: Survey Sites, North Sumatra, Indonesia

In Dak Lak, Vietnam, field research was undertaken in four communes. These included Ea Sar and Ea So communes in Ea Kar District and Yang Kang (Dang Kang) and Cu Kty Communes in Krong Bong District. Ea Kar and Krong Bong districts were chosen for field research as they will be key locations of project activities moving forward.

Table 3: Households by Survey Locations – Dak Lak, Vietnam

Communes	Number of household surveys
Cu Kty	63
Dang Kang	62
Ea Sar	65
Ea So	63
Total	253



Figure 3: Survey Sites, Dak Lak, Vietnam

In **Son La**, Vietnam household surveys were undertaken in Chieng Chan, Na Ot, Pung Tra and Bo Muoi communes. In each commune, 32 households were surveyed in each of the two selected villages. In each commune the choice of villages was made in order to have one mid-land village close to the commune centre and one more highland village far from the commune centre. Within each village respondents were selected randomly amongst households producing cassava.

Table 4: Households by Survey locations – Son La, Vietnam

Communes	Number of household surveys
Bo Muoi	65
Chieng Chan	64
Na Ot	64
Pung Tra	64
Total	257



Figure 4: Survey Sites, Son La, Vietnam

In **Cambodia**, 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.

Table 5: Households by Survey locations – Cambodia

Districts	Number of household surveys
Chitr Borie	101
Siem Bouk	110
Snuol	100
Total	311

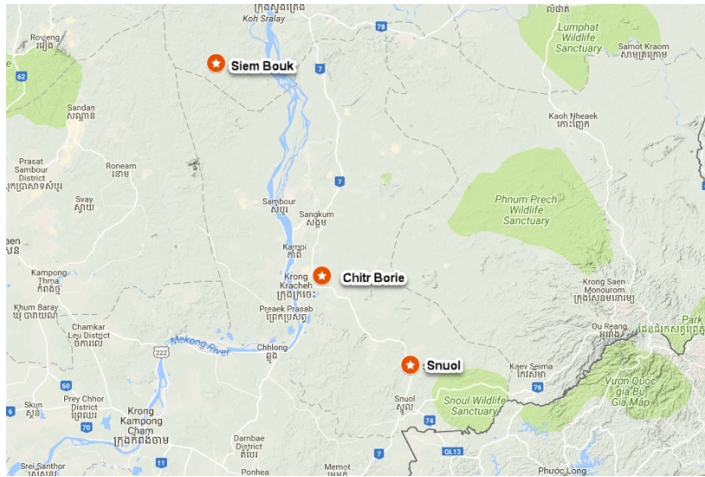


Figure 5: Survey Sites, Cambodia

In **Laos**, the household surveys were undertaken in Bolikhamsay and Xayabouly provinces. Within Bolikhamsay the interviews were conducted in Bolikhan and Viengthong districts and within Xaybouly it was conducted in Kenthao and Paklai districts. A total of 360 households were surveyed across the four districts.

Table 6: Households by Survey Locations – Laos

Provinces	Districts	Number of household surveys
Bolikhamsay	Bolikhan	90
	Viengthong	90
Xayabouly	Kenthao	90
	Paklai	90
Total		360

Note: For the purposes of this report the analysis of the collected survey data are conducted separately for the two provinces within Laos.

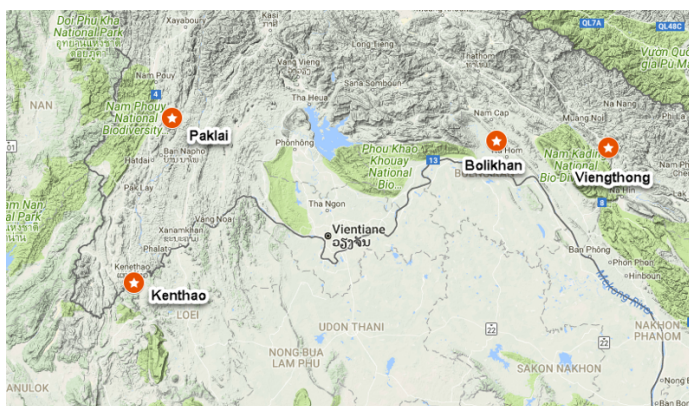


Figure 6: Survey Sites, Laos

Household Survey Results on Pests and Diseases related to Cassava.

The cassava plant is known to be susceptible to numerous pests and diseases capable of imposing a very high financial burden on small farm households. Hence understanding the experience of farmers with various cassava related pests and diseases and the magnitude of their impacts upon the crop is important in order to consider appropriate solutions. We first look into the most common pests and diseases that infect the cassava crop to assess how they have affected the cassava crop of farmers in the study sites as well as their overall experience with these specific pests and diseases. In the latter stage of the report we discuss the opinions of farmers towards adoption of certified planting materials to assess the distribution of certified planting materials as a potential solution to the pest and disease problem.

Cassava Mealybug:

The prevalence of cassava mealybug ranges significantly across the survey sites. It is most prevalent in Sikka with over 88% of farmers claiming to have seen them followed by Kratie and Stung Treng in Cambodia with over 74% reporting having observed mealybug. Mealybug seems to be quite common in Dak Lak, Bolikhamsay, Xayabouly and North Sumatra as well where on average half the farmers surveyed report having seen it. On the contrary, its prevalence is relatively low in Son La with only about 17% having sighted mealybug infestations (Table 7).

Table 7: Proportion of farmers (%) that claim to have seen a cassava mealybug, by site

Ever seen cassava mealybug?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	25.72%	83.59%	46.83%	54.49%	55.00%	51.85%	11.50%
Yes	74.28%	16.41%	53.17%	45.51%	45.00%	48.15%	88.50%
Total respondents	311	256	252	178	180	135	113

Although the earliest sightings of mealybug were in the early 1990s particularly in Kratie and Stung Treng, and Sikka, their pervasiveness seems to have intensified in the last five to seven years. Across all survey sites, the incidence of first sightings are highest in the last five years, particularly in the years between 2014 and 2016 (Figure 7).

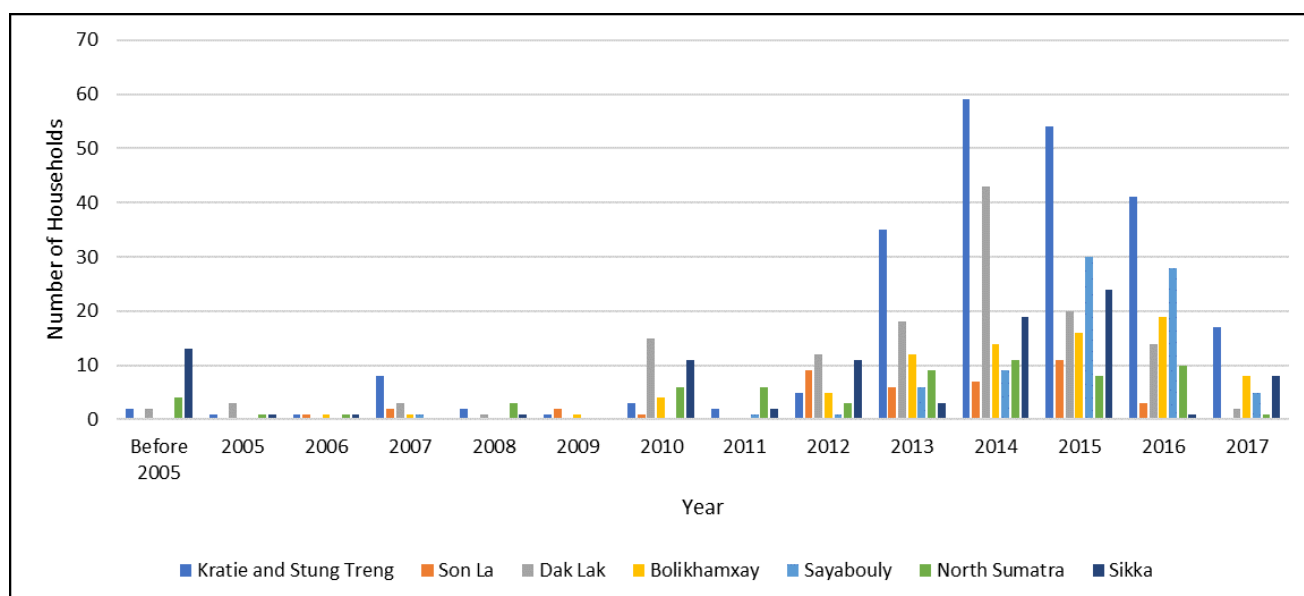


Figure 7: First year mealybug was seen in own or a neighbouring farm, by site

Despite ranking highest in terms of the rate of occurrence, none of the farmers in Sikka claimed to be aware of any control measures for mealybugs (Table 8). Overall, the level of awareness of control measures was generally quite low across all survey sites.

Table 8: Proportion of farmers (%) that claim to know of cassava mealybug control measures, by site

Aware of control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	72.17%	85.71%	87.22%	74.39%	70.37%	84.13%	100.00%
Yes	27.83%	14.29%	12.78%	25.61%	29.63%	15.87%	0.00%
Total Respondents	230	42	133	82	81	63	100

The application of mealybug control measures was as high as 19% in Kratie and Stung Treng followed by 14.5% in North Sumatra, 12% in Bolikhamsay and 11% in Xayabouly. However the incidence of such application was quite low for the Vietnamese sites with less than 5% and about 2% adopting any control measures in Son La and Dak Lak, respectively (Table 9).

Table 9: Proportion of farmers (%) that claim to have applied cassava mealybug control measures, by site

Applied any control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	80.95%	95.24%	97.74%	87.80%	88.89%	85.48%	95.96%
Yes	19.05%	4.76%	2.26%	12.20%	11.11%	14.52%	4.04%
Total Respondents	231	42	133	82	81	62	99

Note: Although no farmers in Sikka claimed to be aware of control measures 4% report having applied control measures

Of the farmers that reported having seen cassava mealybugs, a significant portion across all survey sites reported damage to their crops from the pests. This damage to the cassava crop was particularly high in the Vietnamese sites where up to 95% of farmers in Son La and 88%

of farmers in Dak Lak report having been negatively impacted by the pest. This higher rate of crop damage may also be a result of extremely low adoption rates of any control measures. Across the other surveyed sites, namely Kratie and Stung Treng, along with survey sites in Laos and Indonesia, between 50 and 60% of farmers reported damage to their cassava crop from mealybugs (Table 10).

Table 10: Proportion of farmers (%) that claim to have their cassava crop suffer from cassava mealybug, by site

Did cassava crop suffer from this problem?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	38.96%	4.76%	12.03%	42.50%	48.10%	50.00%	37.37%
Yes	61.04%	95.24%	87.97%	57.50%	51.90%	50.00%	62.63%
Total Respondents	231	42	133	80	79	62	99

The loss in cassava yield seemed to be well correlated with the prevalence of mealybugs. Farmers in Sikka and the Cambodian sites in Kratie and Stung Treng reported highest levels of reduced yields with an average of about 22% loss in yield in Sikka and 20% in Kratie and Stung Treng (Table 11). Mealybug related yield losses were lowest in North Sumatra and Dak Lak.

Table 11: Percent loss in Cassava yield from Mealybugs, by site

Loss in Cassava Yield from Mealybugs	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
0%	21.31%	10.26%	2.63%	10.14%	1.45%	27.91%	6.98%
1% - 5%	15.85%	28.21%	48.25%	39.13%	31.88%	51.16%	19.77%
6%-10%	13.66%	25.64%	35.96%	28.99%	27.54%	9.30%	16.28%
11%-25%	16.39%	20.51%	7.02%	4.35%	28.99%	6.98%	32.56%
26%-50%	26.78%	12.82%	6.14%	13.04%	10.14%	4.65%	18.60%
51%-75%	3.28%	2.56%	0.00%	0.00%	0.00%	0.00%	2.33%
76%-100%	2.73%	0.00%	0.00%	4.35%	0.00%	0.00%	3.49%
Total Respondents	183	39	114	69	69	43	86
Average loss in Cassava Yield	19.83%	13.85%	8.23%	14.01%	13.35%	6.09%	21.74%

Witches Broom:

The prevalence of witches broom ranges significantly across the survey sites. It is most prevalent in Kratie and Stung Treng with over 87% of farmers claiming to have seen them followed by Dak Lak and Bolikhamsay where between 65% and 70% report having observed them. On the contrary, its prevalence is relatively lower in the Indonesian Sites with only 14% and 10% of respondents having sighted them in Sikka and North Sumatra respectively (Table 12).

Table 12: Proportion of farmers (%) that claim to have seen a witches broom infestation, by site

Ever seen a witches broom infestation?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	12.54%	52.72%	29.37%	34.27%	60.89%	90.08%	85.59%
Yes	87.46%	47.28%	70.63%	65.73%	39.11%	9.92%	14.41%
Total respondents	311	239	252	178	179	131	111

Although the earliest sightings of witches broom were sometime in the early 2000s, their pervasiveness seems to have intensified in the last four to six years. Across all survey sites, the incidence of first sightings are highest in the last five years, particularly in the years between 2014 and 2016 (Figure 8).

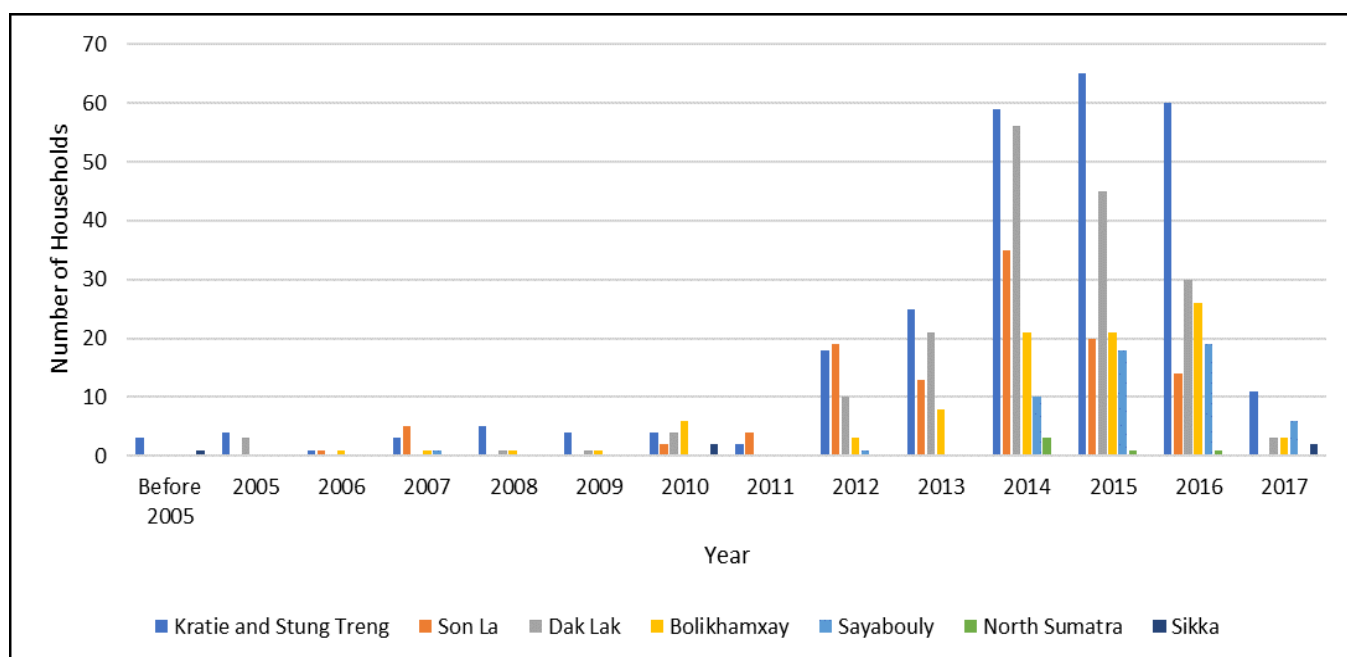


Figure 8: First year witches broom was seen in own or a neighbouring farm, by site

The highest proportion of farmers aware of control measures for witches broom was in Bolikhamsay and Xayabouly although the prevalence of witches broom was higher in other sites. Despite ranking second in terms of witches broom prevalence, less than 5% of farmers in Dak Lak appeared to have much knowledge of control methods (Table 13). Apart from the sites in Laos, the level of awareness of control measures was generally quite low across the rest of the survey sites.

Table 13: Proportion of farmers (%) that claim to know of witches broom control measures, by site

Aware of control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	77.10%	88.50%	95.43%	62.77%	62.26%	100.00%	88.89%
Yes	22.90%	11.50%	4.57%	37.23%	37.74%	0.00%	11.11%
Total Respondents	262	113	175	94	53	6	9

About one in five farmers were involved in applying control measures for witches broom in Kratie and Stung Treng, Son La and the Laotian sites of Bolikhamsay and Xayabouly (*It*

should be noted that while only 11.50% of the 113 respondents in Son La reported knowing about witches broom control measures, 21% claim to have applied such measures). None of the farmers in either of the Indonesian sites were involved in applying any control measures, which is not too surprising given the relatively low prevalence of the disease. However despite 70% of farmers having observed the disease in Dak Lak, only about 1% of farmers claim to be actively controlling them (Table 14).

Table 14: Proportion of farmers (%) that claim to have applied witches broom control measures, by site

Applied any control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	81.75%	78.76%	98.84%	80.85%	83.64%	100.00%	100.00%
Yes	18.25%	21.24%	1.16%	19.15%	16.36%	0.00%	0.00%
Total Respondents	263	113	173	94	55	5	9

Of the farmers that reported having seen witches broom infestations, a significant portion across all survey sites reported damage to their crops from the disease. This damage to the cassava crop was particularly high in the Vietnamese sites where up to 91% of farmers in Son La and 87% of farmers in Dak Lak report having been negatively impacted. This higher rate of damage to the crop in Dak Lak may also be a result of extremely low adoption rates of any control measures. Across Kratie and Stung Treng, Bolikhamsay, and Xayabouly, between 55-70% of farmers report damage from the disease while the rate of damage reported is on par or even higher for the handful in the Indonesian sites that have observed them on their fields (Table 15).

Table 15: Proportion of farmers (%) that claim to have their cassava crop suffer from witches broom infestation, by site

Did cassava crop suffer from witches broom?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	31.30%	8.85%	12.64%	34.74%	43.64%	16.67%	33.33%
Yes	68.70%	91.15%	87.36%	65.26%	56.36%	83.33%	66.67%
Total Respondents	262	113	174	95	55	6	9

The loss of cassava yield across the survey sites seem to be more or less correlated with the prevalence of witches broom. Farmers in Kratie and Stung Treng reported highest levels of reduced yields with an average of about 21% loss in yield. Losses in Son La and Laotian sites of Bolikhamsay and Xayabouly were also quite high at an average of 17%, 11% and 15% respectively. Despite the greater prevalence of the disease in Dak Lak, the loss to cassava yield is relatively lower; which may have been a disincentive for adopting control measures (Table 16).

Table 16: Percent loss in Cassava yield from Witches Broom, by site

Loss in Cassava Yield from Witches Broom (in %)	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
0%	14.60%	1.79%	3.87%	4.55%	8.51%	66.67%	0.00%
1% - 5%	20.35%	30.36%	40.65%	47.73%	44.68%	0.00%	71.43%
6% - 10%	17.70%	22.32%	40.00%	20.45%	21.28%	16.67%	0.00%

11% - 25%	12.83%	20.54%	9.03%	11.36%	14.89%	0.00%	28.57%
26% - 50%	26.99%	23.21%	6.45%	10.23%	10.64%	16.67%	0.00%
51% - 75%	5.75%	1.79%	0.00%	2.27%	0.00%	0.00%	0.00%
76% - 100%	1.77%	0.00%	0.00%	3.41%	0.00%	0.00%	0.00%
Total Respondents	226	112	155	88	47	6	7
Average Loss in Cassava Yield	21.29%	16.61%	9.25%	13.86%	10.13%	8.33%	7.86%

Bacterial Blight:

Bacterial blight was found to be most prevalent in Kratie and Stung Treng with over 61% of farmers claiming to have seen them followed by Sikka with over 55% reporting having observed them. In Dak Lak and the Laotian sites they have been observed by about a third of all farmers. Contrary to the relatively high prevalence across several survey sites, only 1% of farmers in Son La report having seen this particular cassava disease (Table 17).

Table 17: Proportion of farmers (%) that claim to have seen a bacterial blight infestation, by site

Ever seen a bacterial blight infestation??	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	38.59%	99.07%	67.46%	65.17%	67.78%	77.27%	44.55%
Yes	61.41%	0.93%	32.54%	34.83%	32.22%	22.73%	55.45%
Total respondents	311	257	252	178	180	132	110

Although the earliest sightings of bacterial blight were in the early 1990 to mid 1990s particularly in Kratie and Stung Treng and Sikka, their pervasiveness seems to have intensified in the last five to seven years. Across all survey sites, the incidence of first sightings are highest in the last five years, particularly in the years between 2014 and 2016 (Figure 9).

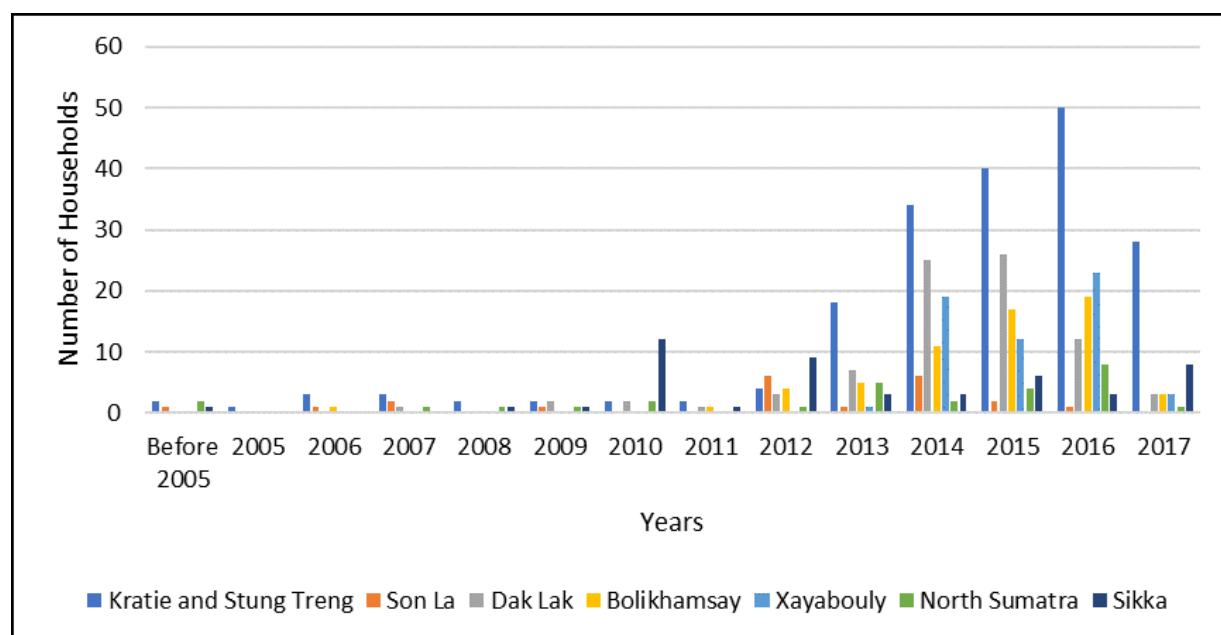


Figure 9: First year bacterial blight was seen in own or a neighbouring farm, by site

Of those farmers that had seen bacterial blight, the highest proportion of farmers aware of control measures for this disease was in North Sumatra; despite its incidence ranking second lowest across all surveyed sites. About a fifth of farmers in Bolikhamsay and Xayabouly and about 15% in Kratie and Stung Treng were also aware of control measures. In Sikka however, despite having the second highest rate of incidence, less than 2% of farmers report having any knowledge of control measures against bacterial blight.

Table 18: Proportion of farmers (%) that claim to know of bacterial blight control measures, by site

Aware of control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	85.34%	95.24%	95.12%	80.95%	81.03%	80.00%	98.36%
Yes	14.66%	4.76%	4.88%	19.05%	18.97%	20.00%	1.64%
Total Respondents	191	21	82	63	58	30	61

The application of bacterial blight control measures was highest in the Vietnamese sites with as many as 79% in Dak Lak and 76% in Son La claiming to have applied control measures against the disease. On the contrary, the low level of awareness matched the likelihood of any action being taken with less than 2% of farmers claiming to have adopted any control measures in Sikka (Table 19).

Table 19: Proportion of farmers (%) that claim to have applied bacterial blight control measures, by site

Applied any control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	64.21%	23.81%	20.73%	70.97%	73.68%	83.33%	98.33%
Yes	35.79%	76.19%	79.27%	29.03%	26.32%	16.67%	1.67%
Total Respondents	190	21	82	62	57	30	60

Farmers in the Indonesian sites were most likely to report damage to their cassava crop resulting from bacterial blight. 55-60% of farmers that have seen the disease in North Sumatra and Sikka report a loss to their cassava yields. The loss was also reported by about a third of farmers in Kratie and Strung Treng and about a quarter of farmers in Son La and Laotian sites of Bolikhamsay and Xayabouly (Table 20).

Table 20: Proportion of farmers (%) that claim to have their cassava crop suffer from bacterial blight, by site

Cassava Suffered from this problem?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	66.49%	76.19%	91.46%	77.78%	75.86%	43.33%	39.34%
Yes	33.51%	23.81%	8.54%	22.22%	24.14%	56.67%	60.66%
Total Respondents	191	21	82	63	58	30	61

The loss in cassava yield was highest for Sikka farmers where the respondents claimed to have lost up to a fifth of their yield on average to the disease. High losses of up to 15% and 11-12% on average were also reported by farmers from Kratie and Stung Treng and the Laotian sites of Bolikhamsay and Xayabouly respectively. The reported yield losses were relatively lower for Dak Lak despite the high prevalence, which may have been as a result of the higher likelihood of using control measures (Table 21).

Table 21: Percent loss in Cassava yield from bacterial blight, by site

Loss in Cassava Yield from bacterial blight (in %)	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
0%	27.52%	28.57%	3.13%	28.00%	6.52%	40.91%	0.00%
1% - 5%	20.13%	42.86%	46.88%	44.00%	36.96%	36.36%	18.60%
6% - 10%	14.09%	7.14%	42.19%	4.00%	19.57%	4.55%	25.58%
11% - 25%	12.75%	14.29%	7.81%	4.00%	28.26%	18.18%	32.56%
26% - 50%	22.15%	7.14%	0.00%	18.00%	8.70%	0.00%	20.93%
51% - 75%	3.36%	0.00%	0.00%	2.00%	0.00%	0.00%	2.33%
76% - 100%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Respondents	149	14	64	50	46	22	43
Average Loss in Cassava Yield	14.99%	6.93%	6.52%	11.02%	12.33%	4.86%	19.37%

Cassava Mites:

Cassava mites are found to be most prevalent in Kratie and Stung Treng with over 70% of farmers claiming to have seen them followed by Sikka where almost 52% reporting having observed them. The cassava mites are also fairly common in Dak Lak, Bolikhamsay, Xayabouly and Son La where between 25 and 40% of farmers report having seen them. The lowest prevalence of cassava mites was observed in North Sumatra with less than 14% having sighted them (Table 22).

Table 22: Proportion of farmers (%) that claim to have seen cassava mites, by site

Ever seen cassava mites?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	29.35%	74.32%	59.92%	69.14%	71.11%	86.15%	48.21%
Yes	70.65%	25.68%	40.08%	30.86%	28.89%	13.85%	51.79%
Total respondents	310	257	252	175	180	130	112

Although the earliest sightings of cassava mites were reported in the early 1990s or even earlier, particularly in Sikka, their pervasiveness seems to have intensified in the last five to seven years. Across all survey sites, the incidence of first sightings are highest in the last five years, particularly in the years between 2014 and 2016 (Figure 10).

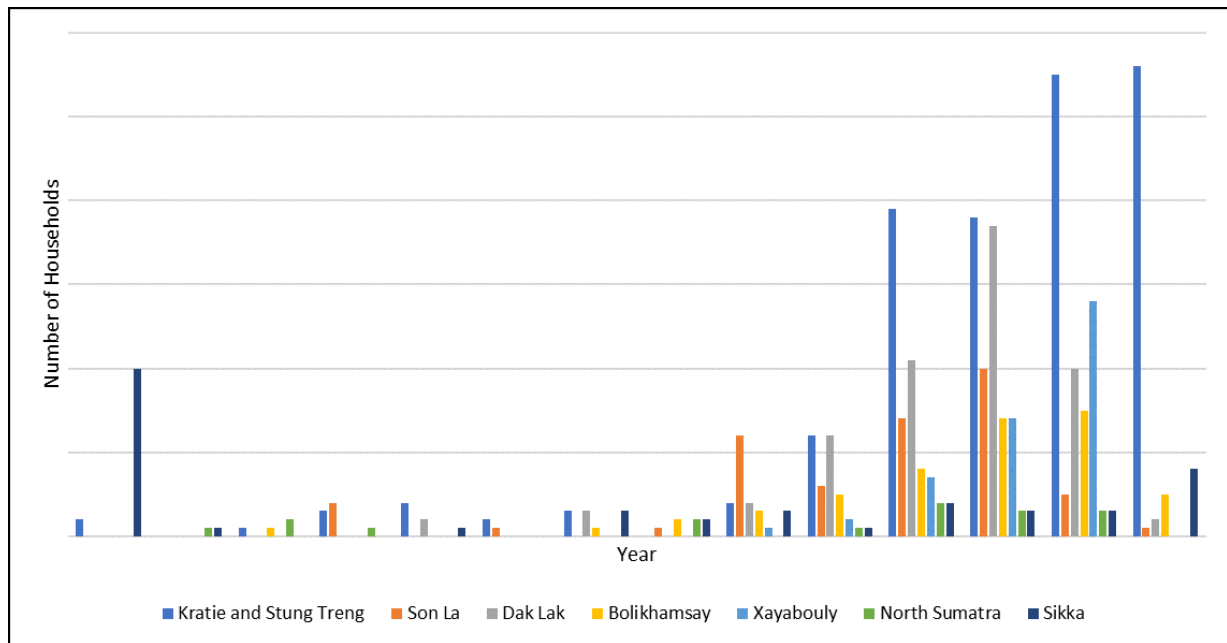


Figure 10: First year cassava mites were seen in own or a neighbouring farm, by site

The general awareness of control measures for cassava mites seem to be quite low across all surveyed sites. Despite enjoying the lowest rates of incidence, North Sumatran farmers ranked the highest in terms of their knowledge of control measures. Kratie and Stung Treng farmers on the other hand with the highest incidence of cassava mites only reported a low 11% awareness rate of any control measures (Table 23).

Table 23: Proportion of farmers (%) that claim to know of cassava mite control measures, by site

Aware of control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	88.58%	96.92%	94.06%	76.36%	90.38%	77.78%	96.55%
Yes	11.42%	3.08%	5.94%	23.64%	9.62%	22.22%	3.45%
Total Respondents	219	65	101	55	52	18	58

The two Indonesian sites contrasted significantly in terms of the application of cassava mite control measures. While there wasn't a single reported case of control measures being applied in Sikka, all 18 farmers aware of cassava control measures in North Sumatra applied them. Across all sites control measures were generally applied if the farmer was aware of such measures (Table 24).

Table 24: Proportion of farmers (%) that claim to have applied cassava mite control measures, by site

Applied any control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	89.50%	95.45%	94.00%	81.48%	92.31%	77.78%	100.00%
Yes	10.50%	4.55%	6.00%	18.52%	7.69%	22.22%	0.00%
Total Respondents	219	66	100	54	52	18	57

Of the farmers that reported having seen cassava mites, a significant portion across all survey sites reported damage to their crops from the pests. This damage to the cassava crop was particularly high in the Vietnamese sites where up to 95% of farmers in Son La and 81% of farmers in Dak Lak report having been negatively impacted by the pest. Negative impacts upon cassava were also reported by 79% of Sikka farmers and 61% of North Sumatra farmers, despite the relatively high application rate of control measures in the latter case (Table 25).

Table 25: Proportion of farmers (%) that claim to have their cassava crop suffer from cassava mites, by site

Did cassava crop suffer from cassava mites?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	48.86%	4.55%	19.00%	56.36%	62.75%	38.89%	20.69%
Yes	51.14%	95.45%	81.00%	43.64%	37.25%	61.11%	79.31%
Total Respondents	219	66	100	55	51	18	58

Between the two Indonesian sites, Sikka farmers suffered the highest cassava yield losses while it was one of the lowest for North Sumatran farmers. The difference across these two sites with regards to their adoption of control measures is likely to have played a significant role in this outcome. High yield losses were also reported in Kratie and Stung Treng followed by Bolikhamsay and Son La (Table 26).

Table 26: Percent loss in Cassava yield from Cassava Mites, by site

Loss in Cassava Yield from Cassava Mites (in %)	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
0%	31.01%	5.56%	2.56%	15.56%	0.00%	42.86%	2.17%
1% - 5%	18.35%	42.59%	52.56%	42.22%	47.50%	42.86%	34.78%
6% - 10%	12.66%	20.37%	35.90%	15.56%	32.50%	0.00%	26.09%
11% - 25%	10.13%	14.81%	7.69%	6.67%	7.50%	0.00%	13.04%
26% - 50%	24.68%	14.81%	1.28%	17.78%	12.50%	14.29%	23.91%
51% - 75%	1.27%	1.85%	0.00%	2.22%	0.00%	0.00%	0.00%
76% - 100%	1.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Respondents	158	54	78	45	40	7	46
Average Loss in Cassava Yield	15.86%	12.06%	6.58%	13.40%	9.93%	7.14%	16.37%

Mosaic Disease:

The prevalence of mosaic disease ranges quite significantly across the survey sites. It is most prevalent in Kratie and Stung Treng with over 65% of farmers claiming to have seen them, followed by Sikka where almost 24% reporting having observed them. The mosaic disease seems to have a modest presence in Bolikhamsay and Dak Lak as well where between 14-

16% of farmers surveyed report having seen them. On the contrary, its prevalence is quite low in Son La and North Sumatra with only about 6-7% having sighted them (Table 27).

Table 27: Proportion of farmers (%) that claim to have seen a mosaic disease infestation, by site

Ever seen a mosaic disease infestation?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	34.41%	93.39%	85.26%	83.52%	89.94%	93.28%	76.11%
Yes	65.59%	6.61%	14.74%	16.48%	10.06%	6.72%	23.89%
Total respondents	311	257	251	176	179	134	113

Although a handful of early sightings were reported in the early 2000s, their pervasiveness seems to have intensified in the last three to four years. Across all survey sites, the incidence of first sightings are highest, particularly in the years between 2014 and 2017 with significant rise in its occurrence in Kratie and Stung Treng (Figure 11).

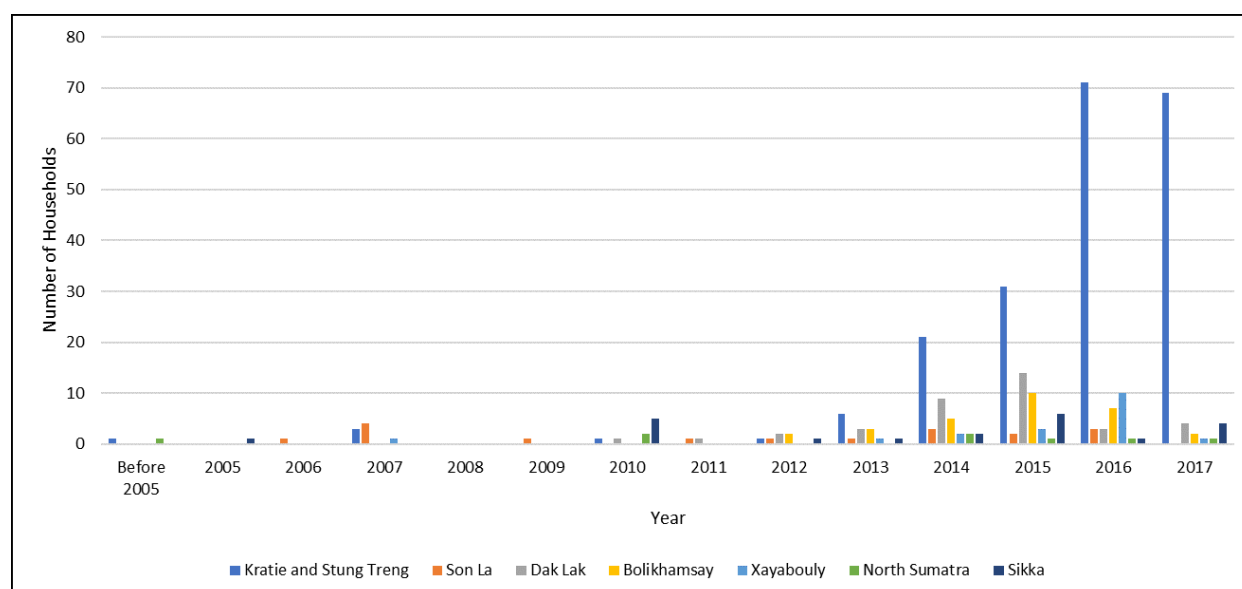


Figure 11: First year mosaic disease was seen in own or a neighbouring farm, by site

The highest proportion of farmers aware of control measures for mosaic disease was in Bolikhamsay although the prevalence of mosaic disease was higher in other sites. Despite ranking second in terms of mosaic disease prevalence, none of the farmers in Sikka appeared to have much knowledge of control methods (Table 28). A similar situation was also observed in North Sumatra and Dak Lak with no farmers reporting any awareness of control measures. Overall, the level of awareness of control measures was generally quite low across all survey sites.

Table 28: Proportion of farmers (%) that claim know of mosaic disease control measures, by site

Aware of control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	88.10%	96.97%	100.00%	77.78%	90.20%	100.00%	100.00%
Yes	11.90%	3.03%	0.00%	22.22%	9.80%	0.00%	0.00%
Total Respondents	210	66	73	54	51	18	56

The application of mosaic disease control measures was as high as 33% in North Sumatra (*It should be noted that the three of the nine farmers that report having applied control measures did not indicate being aware of any such measures*). Application of control measures was also reported by 20% of farmers in Bolikhamsay and about 15% of farmers in Kratie and Stung Treng (Table 29).

Table 29: Proportion of farmers (%) that claim to have applied mosaic disease control measures, by site

Applied any control measures?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	85.29%	100.00%	100.00%	80.00%	100.00%	66.67%	100.00%
Yes	14.71%	0.00%	0.00%	20.00%	0.00%	33.33%	0.00%
Total Respondents	204	17	37	30	18	9	27

Of the farmers that reported having seen mosaic disease infestations, a significant portion across all survey sites reported damage to their crops from the disease. The level of damage however was quite consistent across all surveyed regions where the proportion of farmers reporting yield losses ranged between 40 and 65%, except for Xayabouly where only 22% reported any yield losses. The losses were more likely to be reported by farmers from the Indonesian and Vietnamese sites (Table 30).

Table 30: Proportion of farmers (%) that claim to have their cassava crop suffer from mosaic disease, by site

Did cassava crop suffer from mosaic disease?	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
No	58.33%	35.29%	35.14%	50.00%	77.78%	33.33%	37.04%
Yes	41.67%	64.71%	64.86%	50.00%	22.22%	66.67%	62.96%
Total Respondents	204	17	37	30	18	9	27

The loss in cassava yield seemed well correlated with the prevalence of the mosaic disease with Sikka and Kratie and Stung Treng farmers reporting losses that averaged between 16 and 17%. Average yield losses were also relatively high for Bolikhamsay farmers where average losses of 12.5% were reported. Farmers in the rest of the survey sites reported losses in the single digits between 7-8% (Table 31).

Table 31: Percent loss in Cassava yield from mosaic disease, by site

Loss in Cassava Yield from mosaic disease (in %)	Kratie and Stung Treng	Son La	Dak Lak	Bolikhamsay	Xayabouly	North Sumatra	Sikka
0%	32.61%	28.57%	5.00%	8.00%	11.76%	14.29%	6.25%
1% - 5%	21.74%	28.57%	40.00%	40.00%	47.06%	28.57%	31.25%
6% - 10%	10.14%	21.43%	40.00%	28.00%	23.53%	57.14%	6.25%
11% - 25%	9.42%	7.14%	15.00%	4.00%	11.76%	0.00%	37.50%
26% - 50%	20.29%	14.29%	0.00%	20.00%	5.88%	0.00%	18.75%
51% - 75%	2.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
76% - 100%	2.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Respondents	138	14	20	25	17	7	16
Average Loss in Cassava Yield	15.89%	7.79%	8.65%	12.52%	7.53%	7.14%	16.81%

In the next section we discuss the attitudes and opinions of farmers for adopting certified planting materials that are treated for pests and diseases. The discussion is separated by survey sites.

Dak Lak:

Survey respondents in Dak Lak claim to visit their cassava fields quite regularly with 14% visiting them every day and 34.5% visiting them at least more than once a week. About 22% reported their visits to the field to be weekly with the remainder making even less frequent visits. It was surprising to see that over 9% claimed not making any visits to the fields at all (Table 32, Figure 12).

Table 32: Frequency of visits for inspecting cassava field, Dak Lak

Regularity of field visits	Percent
Never	9.35%
Everyday	14.23%
More often than once a week	34.55%
Weekly	22.36%
More often than once a month	6.91%
Monthly	8.94%
Less often than once a month	3.66%
Total Respondents	246

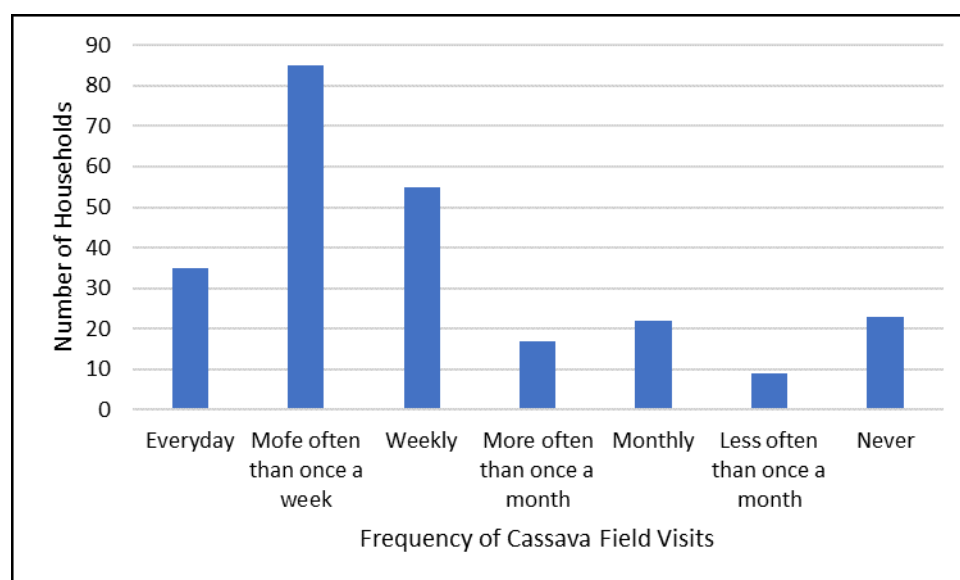


Figure 12: Frequency of visits for inspecting cassava field, Dak Lak

Although cassava field visits are made regularly, less than 5% claim to have made these visits specifically to monitor pests and diseases. Field visits are generally made for other purposes related to cassava production.

The cassava field visits are generally made by the male adult in the household. While 76% of households reported going out to the fields for inspection to be the responsibility of male

adults in the household, visitations were also made by female adults in 23% of households (Table 33). Other members were rarely involved in making such visits.

Table 33: Family member with the responsibility of visiting cassava fields, Dak Lak

Family member responsible for monitoring pest and diseases	Percent
male adult	76.11%
female adult	23.45%
female elderly	0.44%
Total Respondents	226

Only one respondent claimed to be aware of earthworms as a beneficial insect for cassava production. According to the respondent earthworms support cassava growth and hence he/she encouraged survival of earthworms in his/her field.

Cassava Planting Materials:

A range of prices were reported by farmers when asked about the average price of cassava planting material. The average prices specified in Table 34 are separated by the units used by farmers when reporting their prices. It appears that on average farmers pay 1,000 VND per stem.

Table 34: Average Price of Cassava Planting Materials, Dak Lak

Average Prices of Cassava Planting Material based upon Units Chosen	Average Price (VND)
Price per kg(Number of stems not specified)	3,280.00
Price per stem	1,000.00
Price per bundle(Number of stems not specified)	14,762.50
Price per bundle of 12 stems	12,000.00
Price per bundle of 15 stems	11,250.00
Price per bundle of 20 stems	13,882.35

Certified Planting Materials:

Out of the 231 respondents that provided a response only about 28% claimed to be interested in purchasing planting materials that were certified as being pest and disease free. When asked about how much they were willing to pay for certified planting material, the average willingness to pay (based upon 51 valid responses) was 15,529 VND per bundle. It should be noted that we assume a bundle to compose of 20 stems.

With almost 30% of overall responses, the starch factory is regarded as the organization that farmers trust the most for certifying planting materials. The national authority received less than half as many votes with only 13% of responses, followed by the village, district, and province level authorities. Non-government organization fared even worse with only about 3% of the votes. A strong lack of trust for both public and private entities was expressed with 24% responses claiming not to trust any organization with such certification schemes (Table 35).

Table 35: Organization most trusted with certification of planting material, Dak Lak

Organization trusted with certification of planting material	Percent
Starch Factory	29.18%
National Authority	13.07%
Village Authority	12.46%
District Authority	9.73%
Province Authority	6.99%
Non-government Organization	3.34%
Producer of planting material	1.22%
None	24.01%
Total Responses	329

Over half of the respondents did not wish to purchase any certified planting material. High levels of scepticism, uncertainty or unaffordability may have been the reason for many to express such a lack of interest in purchasing certified planting materials. Even amongst those that were willing to include certified planting materials in their overall purchased stock, about 10% of respondents wished to include only 1% of their purchased planting material as being certified. However there were also some farmers that expressed an eagerness to purchase certified planting materials. 7.5% were willing to have 25% of their planting materials as certified while over 9% wanted half of their planting materials to be certified. Furthermore almost 14% expressed a desire to have all of their purchased planting material to be certified (Table 36). On average, farmers expressed a willingness to have about 21% of their purchased planting materials to be certified.

Table 36: Percent of total planting material to be purchased as certified each year, Dak Lak

Percent of total planting material	Percent
0	53.33%
1	9.58%
10	1.67%
15	0.42%
20	3.75%
25	7.50%
30	0.83%
50	9.17%
100	13.75%
Total Respondents	240

Overall, the level of interest in pest and disease free planting materials seem to be quite low with only about 15% indicating that they would be willing to pay for their own planting material to be treated against pests and diseases.

Of the 23 farmers that provided a valid response, on average they claim to be willing to pay 6,569.57 VND per bundle of their own planting material to be treated against pests and diseases (It should be noted that the number of stems that comprised of a bundle was not provided).

About 40% of the 33 respondents willing to have their own planting materials treated did not wish to travel any distance for getting their planting materials treated for pests and diseases. However there were about a quarter that were willing to travel 10 kilometres or more for such treatments. On average farmers were willing to travel about 3.75 kilometres for treating their own planting materials.

Table 37: Distance farmers claim to be willing to travel to have own planting materials treated for pests and diseases, Dak Lak

Distance in Kilometers	Percent
0	39.39%
0.5	3.03%
1	15.15%
2	12.12%
5	6.06%
10	18.18%
20	6.06%
Total Respondents	33

Son La:

Survey respondents in Son La claim to visit their cassava fields relatively less regularly compared to their Dak Lak counterparts. While none of the farmers admitted to not visiting their fields at all as was the case for over 9% of Dak Lak farmers, only 2.3% claimed to visit their fields everyday. The most common interval between visits was once a month which was reported by 28% of respondents. Over 10% visit their fields less often than once a month. There were however a handful that did not explicitly specify their regularity of field visits and simply indicated whether their visits were often or not (Table 38, Figure 13).

Table 38: Frequency of visits for inspecting cassava field, Son La

Regularity of Visits	Percent
Everyday	2.33%
More often than once a week	15.18%
Weekly	17.12%
More often than once a month	21.79%
Monthly	28.02%
Less often than once a month	10.51%
Often	1.56%
Not Often	3.50%
Total Respondents	257

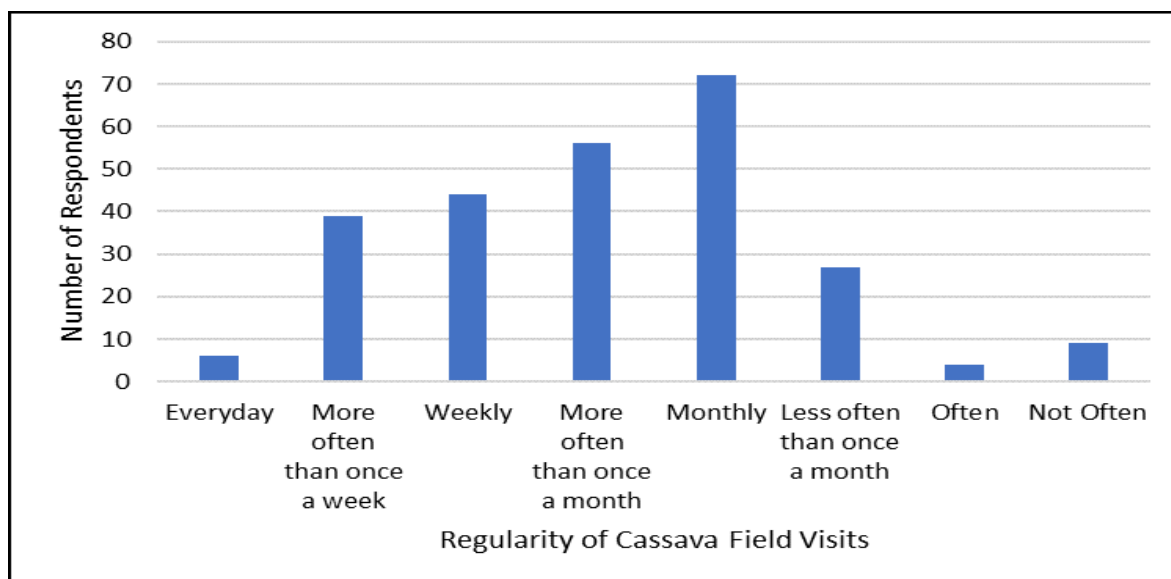


Figure 13: Frequency of visits for inspecting cassava field, Son La

Although cassava field visits are made less regularly compared to Dak Lak farmers, a higher proportion of the visits are reported to be specifically for the purpose of monitoring for pests and diseases. Almost 16% of respondents indicate that their cassava field visits are specifically for activities related to pests and diseases.

The cassava field visits are more likely to be made by the male adult in the household. While 56% of households reported going out to the fields for inspection to be the responsibility of male adults in the household, visitations were also made by female adults in 43% of households (Table 39). Other members were rarely involved in making such visits.

Table 39: Family member with the responsibility of visiting cassava fields, Son La

Family member responsible for monitoring pest and diseases	Percent
male adult	55.78%
female adult	43.43%
male elderly	0.40%
female child	0.40%
Total Respondents	251

Only four respondents claimed to be aware of insects that were beneficial for cassava production. According to the respondents, bees, birds, earthworms as well as snakes help promote cassava production. While nothing was done to encourage an increase in snake population, the farmers claimed to encourage the presence of earthworms, birds and bees.

Despite the availability of only 15 respondents providing a valid price for planting materials, there was a range of units that were reported. The average prices specified in Table 40 are separated by the units used by farmers when reporting their opinion regarding the current price of planting materials. The average price of planting materials in kilograms, which was used as the unit of choice by 12 of the 15 respondents, was 838.89 VND.

Table 40: Average Price of Cassava Planting Materials, Son La

Average Prices of Cassava Planting Material based upon Units Chosen	Average Price (VND)
Price per kg	838.89
Price per bundle (Number of stems not specified)	20,000.00
Price per bundle of 10 stems	15,000.00
Price per bundle of 20 stems	25,000.00

Certified Planting Materials:

Out of the 257 respondents that provided a response almost 57% claimed to be interested in purchasing planting material that was certified as being pest and disease free. When asked about how much they were willing to pay for certified planting material, the responses varied significantly not only in terms of the price they were willing to pay but also in terms of the certified items and units they were willing to pay for. Table 41 below lists the range of items and units and the average amount they were willing to pay for each. A majority of respondents stated their willingness to pay for bundles consisting of 20 stems. The average willingness to pay for such a bundle was 16,387 VND.

Table 41: Average willingness to pay for certified planting materials, Son La

Willing to pay for	Number of Respondents	Average Price (VND)
1 quintal seeds	6	130,833.33
1 ton of seeds	1	1,000,000.00
1 ton of stakes	1	1,000,000.00
10 kg (seed vs. stem not specified)	3	13,333.33
per kg (seed vs. stem not specified)	6	1,116.67
1 stem	5	1,320.00
10 stem bundle	1	3,000.00
15 stem bundle	1	10,000.00
20 stem bundle	49	16,387.76
30 stem bundle	2	3,000.00
40 stem bundle	1	10,000.00
50 stem bundle	2	27,500.00
60 stem bundle	1	50,000.00
bundle (stems not specified)	12	24,583.33
market price	10	---

With almost 25% of overall responses, the village authority is regarded as the organization that farmers trust the most for certifying planting materials. This was followed by the District authority with about 20% of votes, Province authority with 13% of votes and the national authority with 9% of votes. Unlike Dak Lak, there was a high level of trust placed upon government institutions although the level of trust declined as the authority increased in scale from local to national levels. The cassava starch factory and producers of planting materials each received about 9% of votes in terms of the most trusted organization for certification of planting materials (Table 42).

Table 42: Organization most trusted with certification of planting material, Son La

Organization trusted with certification of planting material	Percent
Village Authority	24.34%
District Authority	19.48%
Province Authority	12.92%
National Authority	9.18%
Starch Factory	8.99%
Producer of planting material	8.80%
Non-government Organization	4.31%
None	11.99%
Total Responses	534

About a quarter of the 246 respondents did not wish to include any certified planting materials in their purchased stock. While about 17% only wished to include 10% or less of their purchased planting materials as certified, about 35% showed keen interest where they stated a willingness to have 50% or more of their planting materials as being certified. Of these respondents, about 13% expressed a desire to have all of their planting material to be certified (Table 43). On average, farmers expressed a willingness to have about 31% of their purchased planting materials to be certified.

Table 43: Percent of total planting material to be purchased as certified each year, Son La

Percent of total planting material	Percent
0%	25.20%
1-9%	10.16%
10%	6.91%
11-49%	23.17%
50%	18.70%
51-99%	3.25%
100%	12.60%
Total Respondents	246

More farmers were keen on purchasing certified planting materials rather than having their own planting materials treated against pests and diseases. Only 43% of respondents claimed to be willing to pay for their own planting material to be treated against pests and diseases.

The average willingness to pay to have own planting material treated for pests and diseases also varied significantly both in terms of the level of payment as well as the units referred to. For 44 respondents that used land area (*converted from areas in hectares and meter squared*) the average per hectare willingness to pay was 1,141,004 VND. Farmers also stated their willingness to pay for various sized bundles. The most common bundle comprised of 20 stems for which the average willingness to pay was 12,588 VND (Table 44).

Table 44: Average willingness to pay for own planting materials to be treated for pests and diseases, Son La

Willing to Pay (Unit)	Number of Respondents	Average WTP
Per Hectare	44	1,141,003.74
10 stem bundle	2	7,500.00
20 stem bundle	17	12,588.24
30 stem bundle	2	30,000.00
50 stem bundle	1	20,000.00
60 stem bundle	1	30,000.00
Bundle (stems not specified)	12	20,416.67

Almost half of the 107 respondents willing to have their own planting materials treated did not wish to travel any distance for getting their planting materials treated for pests and diseases. On the contrary almost 13% were willing to travel 10 kilometres or more for such treatments. On average farmers were willing to travel about 3.96 kilometres for treating their own planting materials.

Table 45: Distance farmers claim to be willing to travel to have own planting materials treated for pests and diseases, Son La

Distance (km)	Percent
0	47.66%
1	8.41%
2	16.82%
3	3.74%
5	5.61%
6	2.80%
7	1.87%
10	4.67%
Above 20	8.41%
Total Respondents	107

Kratie and Stung Treng, Cambodia:

Survey respondents in Kratie and Stung Treng claim to visit their cassava fields quite often with 23% claiming to visit them on a daily basis, while only 3% of the farmers admitted to not visiting their fields at all. Another 15% claimed to visit them at least once a week with the remainder making fewer visits. The majority of respondents however did not explicitly specify the regularity of field visits and simply indicated whether their visits were often or not (Table 46, Figure 14). 37% indicated that they go to the fields often while 11% claimed that their visits were not very often.

Table 46: Frequency of visits to inspect field for pests and diseases, Kratie and Stung Treng

Regularity of field visits	Percent
Everyday	23.36%
More often than once a week	8.03%
Weekly	7.30%
More often than once a month	6.93%
Monthly	1.46%
Less often than once a month	1.09%
Never	3.28%
Often	37.23%
Not Often	11.31%
Total Respondents	274

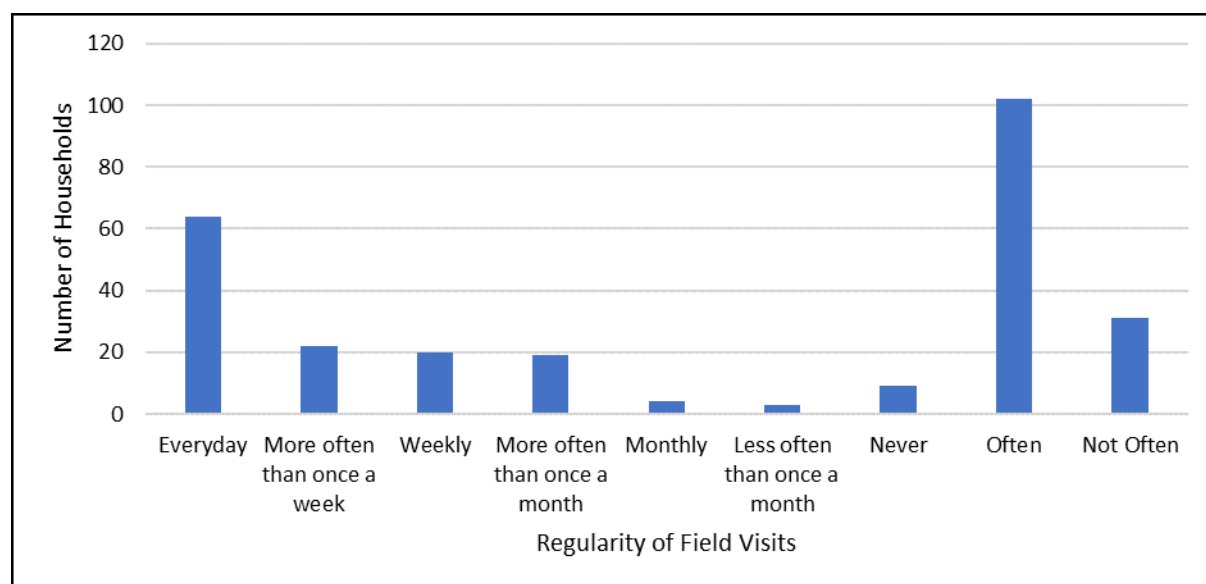


Figure 14: Frequency of visits to inspect field for pests and diseases, Kratie and Stung Treng

The visits to the cassava field are not always motivated by pest and disease inspections. According to the responses only about 28% of the visits were made specifically for activities related to pests and diseases. These cassava field visits are more likely to be made by the male adult in the household. While 58% of households reported going out to the fields for inspection to be the responsibility of male adults in the household, visitations were also made by other elderly males in about 11% of households and by female adults in about 10% of households (Table 47). Other members were rarely involved in making such visits.

Table 47: Family member with the responsibility of visiting fields, Kratie and Stung Treng

Family member	Percent
male adult	58.42%
male elderly	10.65%
female adult	9.97%
male children	3.78%
female elderly	3.09%
other	14.09%
Total Respondents	291

Only three respondents claimed to be aware of insects that were beneficial for cassava production. According to the respondents, earthworms and spiders help promote cassava production. Of the three respondents only one farmer reported having actively encouraged beneficial insects on his/her cassava field.

While there were a range of units used when reporting the average price of cassava planting material, a majority of respondents simply referred to a 'bunch' although no information was provided in terms of how many stems were included in a bunch. A handful of respondents specifying 15 or 20 stems as comprising a bunch reported a price similar to the average price of 4,455.41 Riel that was reported by the 185 respondents who simply referred to the planting materials in terms of a 'bundle' (Table 48). There were 22 respondents who stated their willingness to pay per stem with an average value of 535 Riel per stem.

Table 48: Average Price of Cassava Planting Materials, Kratie and Stung Treng

Willing to pay for	Number of Respondents	Average Price (Riel)
bunch (20 stems)	3	4,333.33
bunch (15 stems)	1	4,500.00
bunch (number of stems not specified)	185	4,455.41
bundle (number of stems not specified)	7	18,670.00
stem	22	535.14

Certified Planting Materials:

Out of the 308 respondents almost 74% declared an interest in purchasing planting material that was certified as being pest and disease free. When asked about how much they were willing to pay for certified planting material, a majority of respondents provided their willingness to pay estimates per stem or a bunch; although additional information was not provided in terms of how many stems were included in a bunch. The per stem average willingness to pay for 15 respondents was 260 Riel per stem. For the 184 respondents using bunch as the unit of purchase the average willingness to pay was 4,315.50 Riel per bunch (Table 49).

Table 49: Average willingness to pay for certified planting materials, Kratie and Stung Treng

Willing to pay for	Number of Respondents	Average Price (Riel)
Per stem	15	260
Per bunch (Number of stems not specified)	184	4,315.49

With over 29% of overall responses, the producer of planting materials is regarded as the organization that farmers trust the most for certifying planting materials. This was followed by the Village authority with about 19% of votes, Non-government organizations with 13% of votes and the Province authority with 9% of votes. The higher level government organizations including the District and National authorities were less likely to be trusted compared to the more local levels. The 0.5% votes received by the starch factory indicates a relationship that is less than healthy between the two groups. A significant lack of trust upon any government or non-government organization was revealed by almost 17% stating they would not trust any organization with a task of certification of planting materials.

Table 50: Organization most trusted with certification of planting material, Kratie and Stung Treng

Organization trusted with certification of planting material	Percent
Producer of planting material	29.11%
Village Authority	18.48%
Non-government Organization	13.42%
Province Authority	11.90%
District Authority	5.57%
National Authority	4.05%
Starch Factory	0.51%
None	16.96%
Total Responses	395

About 15% of the 281 respondents did not wish to include any certified planting materials in their purchased stock. While about 8% only wished to include 10% or less of their purchased planting materials as certified, about 47% showed keen interest where they stated a willingness to have 50% or more of their planting materials as being certified. Of these respondents about 13% expressed a desire to have all of their planting material to be certified. (Table 51). On average, farmers expressed a willingness to have about 39% of their purchased planting materials to be certified.

Table 51: Percent of total planting material to be purchased as certified each year, Kratie and Stung Treng

Percent of total planting material	Percent
0%	15.30%
1-9%	0.71%
10%	7.47%
11-49%	29.54%
50%	32.38%
51-99%	1.78%
100%	13%
Total Respondents	281

More farmers were keen on purchasing certified planting materials rather than having their own planting materials treated against pests and diseases. Only 40% of respondents claimed to be willing to pay for their own planting material to be treated against pests and diseases. The average willingness to pay to have own planting material treated for pests and diseases also varied significantly both in terms of the level of payment as well as the units referred to. For 51 respondents that used land area, the average per hectare willingness to pay was 38,126.41 Riel. Farmers also stated their willingness to pay for various sized bunches. The most common bunch (which did not have the number of stems specified) had an average willingness to pay of 10,046.88 Riel (Table 52).

Table 52: Average willingness to pay for own planting materials to be treated for pests and diseases, Kratie and Stung Treng

Willing to Pay (Unit)	Number of Respondents	Average WTP (Riel)
Per Hectare	51	38,126.41
Bunch of 100	2	35,00.00
Bunch of 200	1	25,000.00
Bunch (stems not specified)	32	10,046.88
One hand tractor	15	24,200.00

A total of 109 respondents were willing to transport their planting materials to have them treated for pests and diseases. 56% of the respondents willing to have their own planting materials treated were willing to travel a maximum of one kilometre. Twenty percent were willing to travel two kilometres away 18% were willing to travel between three and five kilometres. On average farmers were willing to travel about 2.13 kilometres for treating their own planting materials for pests and diseases.

Table 53: Distance farmers claim to be willing to travel to have own planting materials treated for pests and diseases, Kratie and Stung Treng

Distance (km)	Percent
Less than 1 km	17%
1 km	39%
1.5 km	2%
2 km	20%
3 km	10%
4 km	2%
5 km	6%
Between 6 and 10 km	4%
Above 10	1%
Total Respondents	109

Note: Six respondents that specified a distance of 100 km or more were dropped

Bolikhamsay:

Farmers in Bolikhamsay prioritize the need to monitor pests and diseases on their cassava fields. This was shown by almost 60% of the 160 respondents indicating that their visits to their fields were specifically to monitor pests and diseases.

Cassava field visits are more likely to be made by male family members in the household. The household member designated for visiting fields was more often an elderly male followed by a male adult which was the case for almost 64% of households. This responsibility was also shared by an elderly female member in 22.5% of households and a female adult in 12% of households (Table 54). Other members were rarely involved in making such visits.

Table 54: Family member with the responsibility of visiting cassava fields, Bolikhamsay

Family member responsible for monitoring pest and diseases	Frequency
Male elderly	32.47%
Male adult	31.37%
Female elderly	22.51%
Female adult	12.18%
Male child	1.11%
Other	0.37%
Female child	0.00%
Total Respondents	271

Only two respondents claimed to be aware of insects that were beneficial for cassava production although none of them reported taking any action to encourage them.

Certified Planting Materials:

28% of farmers indicated an interest in purchasing certified planting materials that were treated for pests and diseases. With almost 33% of overall responses, the starch factory was regarded as the most trusted organization for certifying planting materials. This was followed by the District authority with about 27% of votes, Province authority with 9% of votes and the village authority with 7% of votes (Table 55). Despite a modest level of trust placed on the District, Province, and Village level authorities, the National authority did not receive a single vote from the farmers. On the contrary, almost 21% said they would not trust any of the organizations with such certification schemes.

Table 55: Organization most trusted with certification of planting material, Bolikhamsay

Organization trusted with certification of planting material	Percent
Starch Factory	32.86%
District Authority	27.14%
Province Authority	9.29%
Village Authority	7.14%
Producer of planting material	2.14%
Non-government Organization	0.71%
None	20.71%
Total Responses	248

Of the 60 farmers that responded, 88% did not wish to include any certified planting materials in their purchased stock. The remaining 12% were willing to have up to 50% of their purchased planting materials as certified.

With less than 22% willing to pay to have their own planting materials treated against pests and diseases, it appears relatively more farmers are keen on purchasing certified planting materials instead.

The 22 respondents willing to have their own planting materials treated were willing to travel on average 2.86 kilometres to have them treated (Table 56). Over 50% of them were willing to travel only one kilometre.

Table 56: Distance farmers claim to be willing to travel to have own planting materials treated for pests and diseases, Bolikhamsay

Distance	Percent
0.5	9.09%
1	54.55%
2	9.09%
3	9.09%
5	9.09%
10	4.55%
20	4.55%
Total Respondents	22

Xayabouly:

Farmers in Xayabouly prioritize the need to monitor pests and diseases on their cassava fields. This was shown by 63% of the 155 respondents indicating that their visits to their fields were specifically to monitor pests and diseases.

Cassava field visits are more likely to be made by male family members in the household. The household member designated for visiting fields was more often the male adult followed by an elderly male which was the case for almost 63% of households. This responsibility was also shared by an elderly female member in about 19% of households and

a female adult in 17% of households (Table 54). Other members were rarely involved in making such visits.

Table 57: Family member with the responsibility of visiting cassava fields, Xayabouly

Family member responsible for monitoring pest and diseases	Frequency
Male adult	32.46%
Male elderly	30.22%
Female elderly	18.66%
Female adult	17.16%
Male child	0.75%
Female child	0.37%
Other	0.37%
Total Respondents	268

Only four respondents claimed to be aware of insects that were beneficial for cassava production although none of them reported taking any action to encourage them.

Certified Planting Materials:

Less than 7% of farmers indicated an interest in purchasing certified planting materials that were treated for pests and diseases. The level of interest demonstrated was four time lower than by their Bolikhamsay counterparts. In contrast to farmers in Bolikhamsay, Xayabouly farmers placed more trust in the government over private starch factories for any certification schemes. With almost 12% of overall responses, the starch factory was regarded as the most trusted organization for certifying planting materials. With almost 16% of votes, the Province authority was regarded as the most trustworthy followed by the Village authority with about 13% of votes and finally the District authority with 12% of votes (Table 55). Despite a modest level of trust placed on government institutions, the National authority did not receive a single vote from the farmers. The starch factory ranked fourth with over 7% of votes. On the contrary, almost 52% said they would not trust any of the organizations with such certification schemes. While the lack of trust on any public or private organization was quite high for Bolikhamsay, it was even higher in the case of Xayabouly.

Table 58: Organization most trusted with certification of planting material, Xayabouly

Organization trusted with certification of planting material	Percent
Province Authority	15.74%
Village Authority	12.96%
District Authority	12.04%
Starch Factory	7.41%
None	51.85%
Total Responses	108

Although 7% of farmers initially showed some interest in purchasing certified planting materials, when asked about the share of purchased certified planting materials they would like to include in their overall stock, all of the 75 respondents indicated 0%.

Of the 140 respondents, only one farmer claimed to be willing to pay to have their own planting material treated against pests and diseases. This respondent claimed to be willing to travel up to two kilometres to have his/her planting material treated for pests and diseases.

North Sumatra:

Only about 10% of cassava field visits made by North Sumatran farmers are specifically for monitoring pests and diseases.

Cassava field visits are more likely to be made by the male adult in the household. While 75% of households reported going out to the fields for inspection to be the responsibility of male adults in the household, visitations were also made by female adults in about 18% of households (**Error! Reference source not found.**). Other members were rarely involved in making such visits.

Table 59: Family member with the responsibility of visiting cassava fields, North Sumatra

Family member responsible for monitoring pest and diseases	Percent
male adult	75.20%
female adult	17.60%
Male child	5.60%
Male elderly	1.60%
Total Respondents	125

Only one farmer claimed to be aware of insects that were beneficial for cassava production. According to the respondent locusts helped promote cassava production, however the farmer did not actively encourage them on his/her fields.

All seven farmers that provided a valid price for planting materials claimed that a single stem cost 30 Rupiahs.

Certified Planting Materials:

Only 15% of farmers indicated an interest in purchasing certified planting materials that were treated for pests and diseases. The three farmers that provided a reasonable estimate of their willingness to pay to purchase certified planting materials claimed to be willing to pay between 300-350 Rupiah per stake. (*Note: the difference between a stem and a stake is not provided*)

With over 42% of overall responses, the village authority is regarded as the organization that farmers trust the most for certifying planting materials. This was followed by the starch factory with 32% of votes, producer of planting materials with 8% of votes and the District

authority with about 6% of votes. Over 8% also said they would not trust any of the organizations with such certification schemes (Table 60).

Table 60: Organization most trusted with certification of planting material, North Sumatra

Organization trusted with certification of planting material	Frequency
Village Authority	42.20%
Starch Factory	32.37%
Producer of planting material	8.09%
District Authority	5.78%
Non-government Organization	2.31%
Province Authority	0.58%
National Authority	0.58%
None	8.09%
Total Responses	173

Of the 77 farmers that responded, 91% did not wish to include any certified planting materials in their purchased stock. The remaining 9% were willing to have between 10% and 100% of their purchased planting materials as certified.

While the overall interest with certified planting materials was quite low, more farmers were willing to purchase certified planting materials rather than have their own planting materials treated against pests and diseases. Only 11% of respondents claimed to be willing to pay for their own planting material to be treated for pests and diseases.

The three farmers that provided a seemingly valid estimate of their willingness to pay to have their own planting materials treated for pests and diseases, claimed to be willing to pay between 20 and 25 Rupiah per stake.

Only four respondents were willing to travel some distance to have their planting materials treated for pests and diseases. These respondents were willing to travel between one and two kilometres.

Sikka:

Only about 3% of cassava field visits made by Sikka farmers were specifically meant for monitoring for pests and diseases.

Cassava field visits are more likely to be made by the male adult in the household. While 63% of households reported going out to the fields for inspection to be the responsibility of male adults in the household, visitations were also made by female adults in about 34% of households (Table 61). Other members were rarely involved in making such visits.

Table 61: Family member with the responsibility of visiting cassava fields, Sikka

Family member responsible for monitoring pest and diseases	Frequency
male adult	62.89%
female adult	34.02%
Male child	2.06%
Female child	1.03%
Total Respondents	97

None of the farmers were aware of any insects that were beneficial for cassava production.

There were only a handful of farmers that provided the going price of planting materials. The average price for a bunch (number of stems not indicated) of the planting materials as stated by four farmers was 43,750 Rupiahs while the average price of an individual stake as reported by two farmers was 500 Rupiah.

Certified Planting Materials:

Over 46% of farmers indicated an interest in purchasing certified planting materials that were treated for pests and diseases.

With almost 60% of overall responses, the village authority is regarded as the organization that farmers trust the most for certifying planting materials. This was followed by the National authority 13% of votes, non-government organizations with 11% of votes and the District authority with about 9% of votes (Table 62).

Table 62: Organization most trusted with certification of planting material, Sikka

Organization trusted with certification of planting material	Frequency
Village Authority	59.84%
National Authority	12.60%
Non-government Organization	11.02%
District Authority	8.66%
Starch Factory	6.30%
Province Authority	1.57%
Total Responses	127

Of the 28 farmers that responded, 32% did not wish to include any certified planting materials in their purchased stock. About 21% were willing to have up to 25% certified planting materials in their purchased stock while a further 21% were willing to have up to half of their purchased stock that was certified. About 18% showed keen interest where they stated a willingness to have 75% or more of their planting materials as being certified. Of these respondents over 14% expressed a desire to have all of their planting material to be certified. (Table 63). On average, farmers expressed a willingness to have about 34% of their purchased planting materials to be certified.

Table 63: Percent of total planting material to be purchased as certified each year, Sikka

Percent of total planting material	Percent
0	32.14%
10	3.57%
20	3.57%
25	21.43%
50	21.43%
75	3.57%
100	14.29%
Total Respondents	28

More farmers were willing to purchase certified planting materials rather than have their own planting materials treated against pests and diseases. Only 24% of respondents claimed to be willing to pay for their own planting material to be treated for pests and diseases.

Nine farmers indicated an average willingness to pay of 15,055.56 Rupiah per bunch (number of stems not indicated) to have their own planting materials treated for pests and diseases. Additionally, another five farmers claimed to be willing to pay on average 340 Rupiah per stake for such treatment.

15 farmers were willing to travel some distance to have their planting materials treated for pests and diseases. These respondents were willing to travel on average 7.8 kilometres to have such treatment conducted.

Concluding Remarks:

Across the survey sites in this study, it appears that farms in Kratie and Stung Treng and Sikka are most infected by the various forms of pests and diseases discussed above. While a higher proportions of farmers from these areas report having seen the pests and diseases, there were also more frequent and more serious reports of cassava damages. Compared to farmers in Kratie and Stung Treng, Sikka farmers seem to be less capable of coping with the situation due to the lack of information and/or resources for employing any pest and disease control measures. In general there seems to be significant opportunities for improving cassava yield through adequate interventions that aid with pest and diseases management.

The pervasiveness of all five pests and diseases discussed above seem to have increased at an alarming rate across all surveyed sites particularly in the past five years. An increase in the movement of people, equipment and seeds along with factors such as the changing climate may all have contributed to this result. Given that the frequency and intensity of all of these factors are on the rise, it is imperative that management strategies are put in place to ensure cassava yields are maintained and the livelihoods of rural farmers are safeguarded.

While the level of interest shown by farmers for adopting certified planting materials varied across the survey regions, the results reveal much scope for implementing certification schemes. With the rising treat of pests and diseases to cassava yield in recent years, the demand for improved planting materials is bound to increase. Additionally, through better education and effective advertising, the level of awareness can be greatly improved. Across all sites there was relatively more interest shown for purchasing certified planting materials rather than having farmers' existing planting materials treated for pests and diseases. Furthermore, even those farmers willing to have their own planting materials treated for pests and diseases were not too keen on traveling more than a few kilometres for such treatment.

The success related to the distribution and adoption of certified planting material is very much dependent upon the level of trust between the farmers and the institution responsible for conducting certification schemes. As the level of trust each government or non-government institution had with farmers varied significantly across survey sites, the selection of an appropriate institution tasked with this endeavor is bound to be location specific.