



Australian Government

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# Agronomic & economic results of improved cassava management (2017-18 & 2018-19)

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# Introduction

- Present the results of trials in 2017-19 and also 2018-19
  - Varieties
  - Fertiliser application
  - Intercropping
- Agronomic results
- Economic analysis
- Observations and future plans
  
- Implications of results will be presented tomorrow.



# Varieties assessments

# Variety assessment (2017-18)

Fresh root yield (t ha<sup>-1</sup>) of 7 Cassava varieties in 3 Districts

Variety	Kenethao	Paklai	Viengthong
KM140	28.3	22.7	19.8
KM21-12	21.5	25.3	10.7
KU50	24.7	23.8	11.8
Local	23.9	28.8	15.1
Rayong 11	28.3	28.2	21.3
Rayong 72	22.3	30.1	17.1
Rayong 9	27	25.1	14.5

	Fresh Root yield	Starch content	Starch yield
	(t ha <sup>-1</sup> )	(% fresh root weight)	(t ha <sup>-1</sup> )
Rayong 11	25.91 <sub>a</sub>	30.67 <sub>a</sub>	7.9 <sub>a</sub>
KM140	23.59 <sub>ab</sub>	23.54 <sub>bcd</sub>	5.5 <sub>b</sub>
Rayong 72	23.19 <sub>ab</sub>	23.60 <sub>bcd</sub>	5.6 <sub>ab</sub>
Local	22.58 <sub>ab</sub>	25.57 <sub>bc</sub>	5.7 <sub>ab</sub>
Rayong 9	22.19 <sub>ab</sub>	26.70 <sub>b</sub>	6.3 <sub>ab</sub>
KU50	20.12 <sub>ab</sub>	21.65 <sub>d</sub>	4.7 <sub>b</sub>
KM21-12	19.16 <sub>b</sub>	22.76 <sub>cd</sub>	4.7 <sub>b</sub>

Rayong 11



Rayong 72

Farm gate prices do not consider starch content

# Evaluation of varieties for direct consumption

(opportunistic activity requested by farmers in Viengthong)

No	Treatment	Root yield (t/ha)	% starch content
1	KM140	9.8	21
2	Local	6.5	19
3	NARC61	7.8	22

No	Treatment	Female			Male		
		Not good	Good	very good	Not good	Good	very good
1	KM140	2	1	7	2	4	7
2	Local	3	5	2	4	6	3
3	NARC61	5	4	1	5	4	4



# New advanced clones

- CIAT introduced 42 new clones to Laos in 2017-18
- Initial screening at NAFRI
- Preliminary yield trial in 2018-19 of 5 clones
- Move to multi-location trial in 2020-21





# Improving the utilisation of fertiliser

# Almost zero adoption of fertiliser in sites in Lao PDR

	<b>Bolikhan</b>	<b>Kenthao</b>	<b>Paklai</b>	<b>Viengthong</b>	<b>Total</b>
<b>Do you apply organic fertiliser to your cassava?</b>	1.1%	0.0%	0.0%	0.0%	0.3%
<b>Do you apply inorganic fertiliser to your cassava?</b>	1.1%	0.0%	0.0%	0.0%	0.3%
<b>Do you understand what the NPK values mean on the fertiliser you apply?</b>	1.1%	1.1%	1.1%	0.0%	0.8%
<b>Have you ever seen a fertiliser trial on cassava?</b>	6.7%	4.4%	3.3%	3.3%	4.4%
<b>Are you interested in visiting a fertiliser demonstration trial to see the result on production and returns?</b>	53.3%	41.1%	52.2%	56.7%	50.8%
<b>Are you interested in conducting a trial on your own land?</b>	47.8%	44.4%	48.9%	53.3%	48.6%



# Fertiliser treatments x 2 varieties (2017-18)

Treatment	Actual fertilizer application (kg ha <sup>-1</sup> )			
	Urea (46-0-0)	TSP (00-42-00)	KCL	Manure
Control (00N-00P-00K)	-	-	-	-
NP low rate without K (40N-10P-0K)	87.00	54.60	-	-
Balanced NPK low rate (40N-10P-40K)	87.00	54.60	80.30	-
Balanced NPK low rate (40N-10P-40K)+Manure (5 t/ha)	87.00	54.60	80.30	5,000
Available fertilizer in local market (15-15-15) at 40N-40P <sub>2</sub> O <sub>5</sub> -40K <sub>2</sub> O	266.65			-
Balanced NPK high rate (80 N-20P-80K)	173.90	109.10	160.60	-

Commonly used on rice and available in markets



Compoun



Urea



TSP



KCL

Difficult to obtain in local markets

# Differential impact of CWBD by variety



KU50

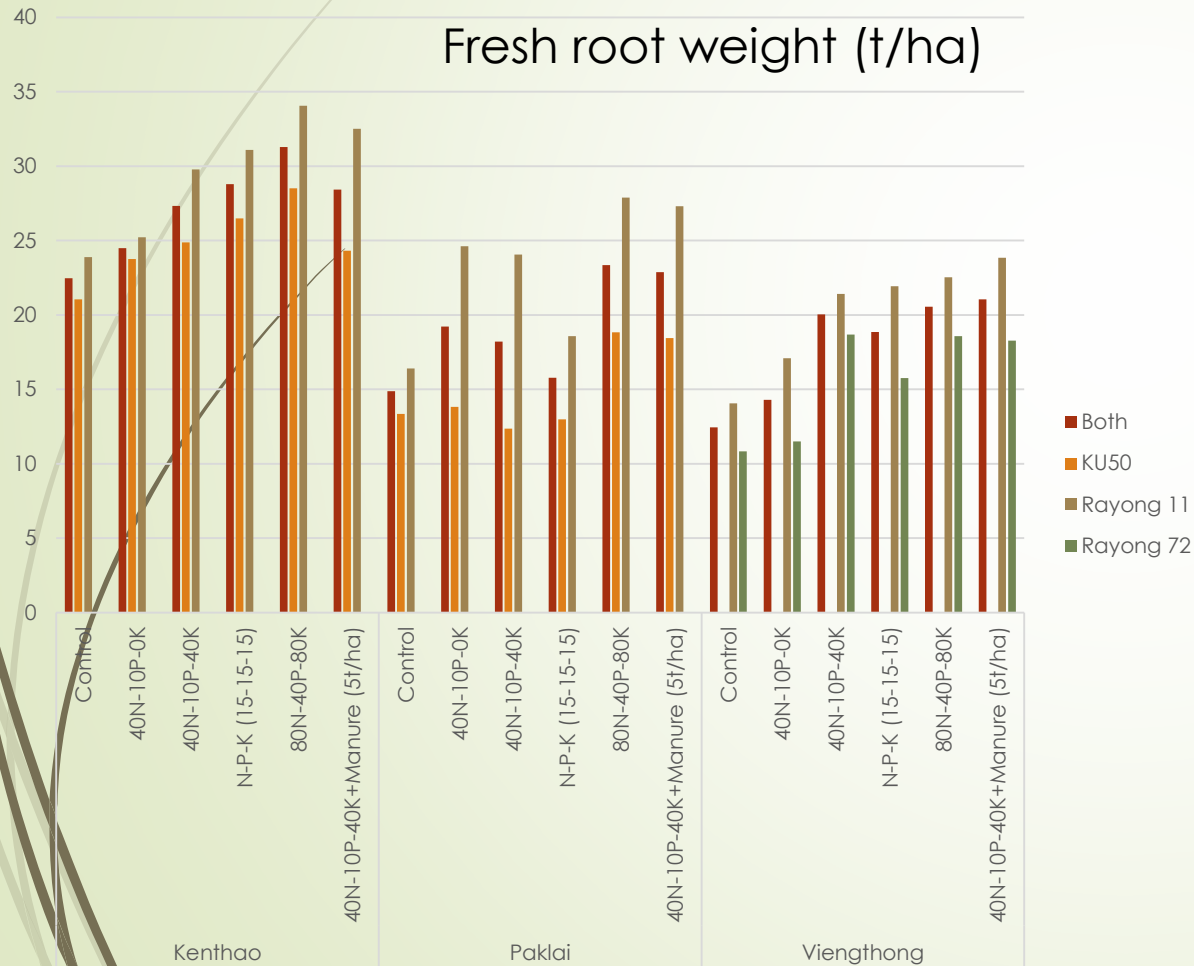
Rayong 11

# CWBD symptoms worse in zero treatment

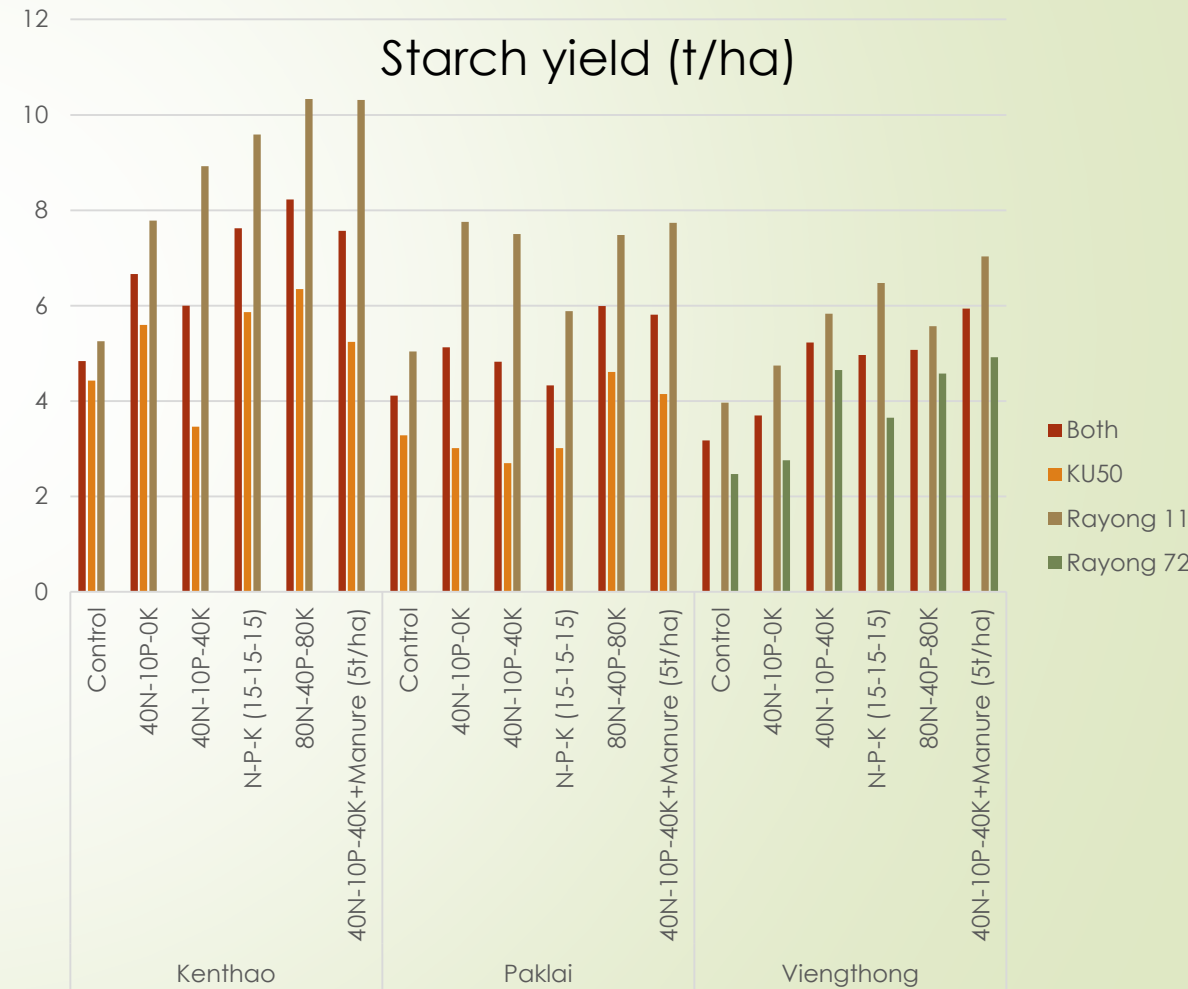


# Fresh root weight and starch yield

## Fresh root weight (t/ha)



## Starch yield (t/ha)



# Economic analysis (Net benefits)

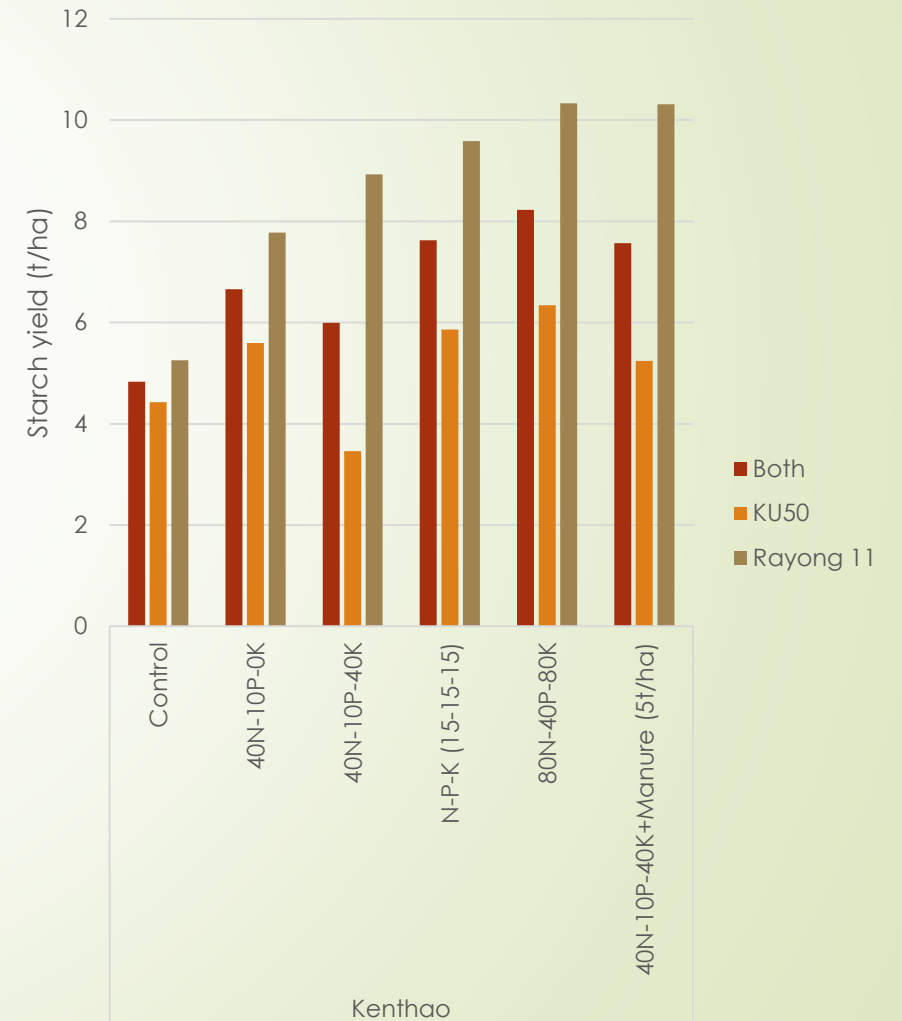
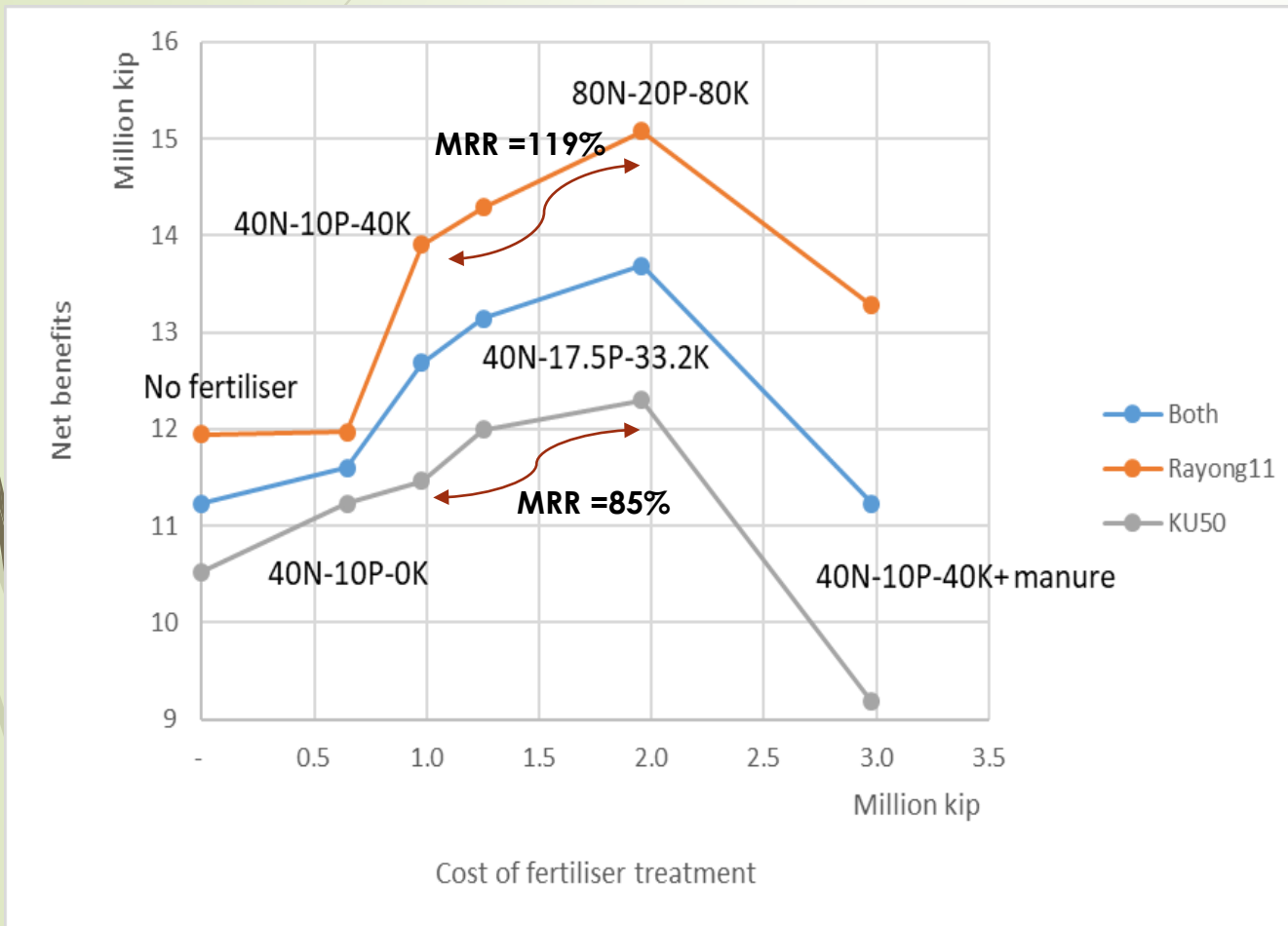
District/Treatment	Both	KU50	Rayong 11	Rayong 72
<b>Kenthao</b>				
Control	11,234,722	10,522,222	11,947,222	
40N-10P-0K	11,601,324	11,233,963	11,968,685	
40N-10P-40K	12,686,026	11,462,415	13,909,637	
N-P-K (15-15-15)	13,142,578	11,995,356	14,289,801	
<b>80N-40P-80K</b>	<b>13,686,220</b>	<b>12,296,637</b>	<b>15,075,803</b>	
40N-10P-40K+Manure (5t/ha)	11,229,081	9,181,859	13,276,304	
<b>Paklai</b>				
Control	7,432,639	6,668,056	8,197,222	
40N-10P-0K	8,963,824	6,261,740	11,665,907	
40N-10P-40K	8,124,915	5,197,137	11,052,692	
N-P-K (15-15-15)	6,632,856	5,234,245	8,031,467	
<b>80N-40P-80K</b>	<b>9,718,859</b>	<b>7,454,970</b>	<b>11,982,748</b>	
40N-10P-40K+Manure (5t/ha)	8,456,165	6,237,415	10,674,915	
<b>Viengthong</b>				
Control	3,732,500		4,215,000	3,250,000
40N-10P-0K	3,642,713		4,478,963	2,806,463
<b>40N-10P-40K</b>	<b>5,032,415</b>		<b>5,441,581</b>	<b>4,623,248</b>
N-P-K (15-15-15)	4,399,245		5,327,578	3,470,912
80N-40P-80K	4,208,720		4,800,803	3,616,637
40N-10P-40K+Manure (5t/ha)	3,334,915		4,169,915	2,499,915

~50% MRR

Note: Net Benefits do not equal profit. Only costs that vary are considered (fertiliser)

# Kenthao District example of marginal rate of return (MRR)

Price = 500kip/kg





# Fertiliser trial 2018-19

- ▶ Continue fertiliser trial in one location in each Province (ordered by cost)
  - ▶ P1 - Control (No fertiliser)
  - ▶ P3 - N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O (40-20-40)
  - ▶ P2 - N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O (15-5-30): 300 Kg/ha
  - ▶ P4 - N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O (80-20-80)
- ▶ Have a number of demonstration of 'with and without' fertiliser of a simple recommendation.
  - ▶ No calculation of NPK required - N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O (15-5-30): 300 Kg/ha

# Results of 2018-19

Fertilizer	Fresh root yield (t ha <sup>-1</sup> )		Starch content (%)	
	Xayaboury	Bolikhamxay	Xayaboury	Bolikhamxay
P1	20.3 ± 5.3	7.3 ± 1.4	30.4	27.7
P3	34.2 ± 1.5	12.4 ± 0.1	29.2	29.7
P2	36.5 ± 2.3	9.1 ± 0.7	30.7	28.4
P4	32.2 ± 5.2	10.3 ± 1.2	30.1	28.3
<b>Location</b> P<0.001				
<b>Treatment</b> P=0.005				
<b>Location X Treatment</b> P=0.064				





# Economic analysis of 2018-19 trial

			Xayabouli		Bolikhamxai	
	Treatment	Cost	Net Benefits	MRR	Net Benefits	MRR
P1	Control (No fertiliser)	0	10,156,944		3,662,500	0
P3	N:P2O5:K2O (40-20-40)	814,157	16,287,232	753%	<b>5,401,120</b>	<b>214%</b>
<b>P2</b>	<b>N:P2O5:K2O (15-5-30): 300 Kg/ha)</b>	<b>1,320,000</b>	<b>16,950,833</b>	<b>131%</b>	3,216,806	D
P4	N:P2O5:K2O (80-20-80)	1,401,172	14,709,939	D	3,761,328	D



Root rot cause low yields and a reduction in net benefits

# Fertiliser demonstration



# Agronomic results of demonstration trials

Commercially available NPK (15-5-30) 300 kg ha<sup>-1</sup>

District	Fresh root yield (t ha <sup>-1</sup> )		Starch content (%)	
	No Fertilizer	With Fertilizer	No Fertilizer	With Fertilizer
<b>Kenethao</b>	24.8 ± 2.7	36.8 ± 2.3	28.6 ± 2.8	25.9 ± 2.2
<b>Paklai</b>	25.0 ± 2.4	33.5 ± 2.1	24.0 ± 5.2	24.9 ± 3.9
<b>Viengthong</b>	26.4 ± 2.6	29.7 ± 2.4	29.1 ± 0.2	30.9 ± 1.3
<b>Bolikan</b>	12.3 ± 1.5	21.1 ± 2.1	25.1 ± 1.7	27.5 ± 2.3
<b>Location</b>	P <0.001, l.s.d. 3.93			
<b>Treatment</b>	P <0.001, l.s.d. 2.78			
<b>Location X Treatment</b>	P=0.169, l.s.d. 5.56			

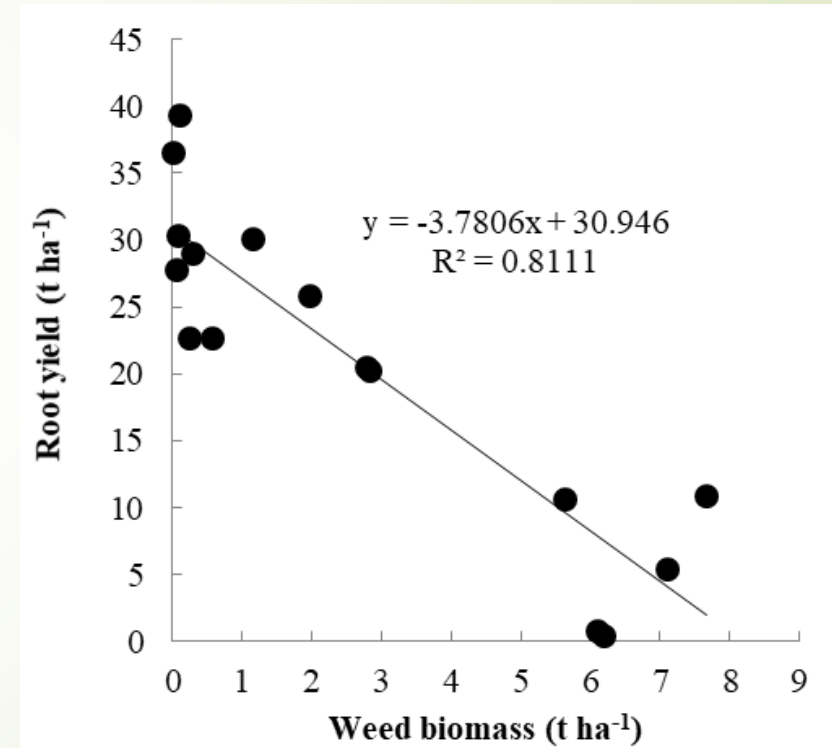


# Economic results of demonstrations

District	Paklai	Kenthao	Bolikan	Viengthong
Yield without fertiliser (t/ha)	27.8	24.8	12.3	26.4
Yield with fertiliser (t/ha)	37.2	36.8	21.1	29.7
Difference (t/ha)	9.5	12.0	8.8	3.3
Current price (kip/kg)	540	540	540	500
Cost fertiliser (kip/ha)	1,320,000	1,320,000	1,320,000	1,320,000
<b>Current cassava root price</b>				
Marginal Net Benefits (kip/ha)	3,785,333	5,140,667	3,428,240	313,796
MRR (%)	286.8%	389.4%	259.7%	23.8%
<b>Low cassava root price: 300 kip per ton</b>				
Marginal Net Benefits (kip/ha)	1,516,296	2,269,259	1,317,911	- 339,722
MRR (%)	114.9%	171.9%	99.8%	-25.7%

# Addressing weeds remains and important issues

- Rice remains the priority for labour utilisation (establishment and harvest)
- Weeding often did not occur or too late impacting the response to fertiliser.
- Herbicide widely used in some districts, but not others. New regulations will impact there use.



Khanthavong et.al. 2016

# Impact of cassava returns

	Without fertiliser	With fertiliser
Material costs (A)	1,600,000	2,920,000
Labour costs (B)	6,420,000	6,660,000
Total costs (A+B = C)	8,020,000	9,580,000
Revenue (D)	16,114,691	21,598,198
Net returns (D-C)	8,094,691	12,018,198
Net returns to household resource (D-A = E)	14,514,691	18,678,198
Labour days (F)	152	158
Net returns per labour day (E/F)	95,491	118,216
<b>Low price scenario</b>		
Revenue	8,335,185	11,171,481
Net returns	315,185	1,591,481
Net returns to household resource	6,735,185	8,251,481
Labour days	152	158
Net returns per labour day	44,310	52,225





# Farmer responses

## ► **Variety**

- Farmer adopted Rayong 11 and expand on bigger area in Paklai
- Farmer still eating cassava during rice deficient in Viengthong
- Limited access to planting material (especially free from CWBD) limiting rate of expansion of new varieties.

## ► **Fertiliser**

- Farmer recognised fertilizer application increasing cassava root yield and root weight in Kenethao and Bolikhan
- Farmer asked buying fertilizer in Bolikhan

## ► **Disease and seed system**

- advice on recognising CWBD and positive selection has reduced level of CWBD in Paklai
- Farmer recommended control CWBD to other farmer in nearby village in Kenethao



# Activities in 2019-2020

- ▶ Expand the number of demonstrations
  - ▶ Activities in 20 villages across the 4 Districts
  - ▶ Involving 40 households
  - ▶ Variety the farmers own existing variety or Rayong 11 supplied by the project
  - ▶ Large plots (un-replicated)
  - ▶ Two treatments or two kind of fertilizer: 14-7-35 and 15-7-18 (300 kg/ha)
- ▶ Continue fertiliser trial (1 location per Province)
  - ▶ No fertiliser
  - ▶ Thai fertiliser blended for cassava\*(15-5-30 commercially available) 6 bag/ha
  - ▶ NPK 40-20-40
  - ▶ NPK 80-20-80
  - ▶ Vietnamese fertilizer