



Susceptibility and yield impact of CMD on cassava varieties in Cambodia(2018-19)

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Background

- Cambodia increased 40-fold, from 16,000 to 684,070 ha (MAFF, 2017)
- Ratanakiri Province (eastern Cambodia, 2015) - SLCMV was reported (Wang et al., 2016)
- Impact of CMD on yield
- CMD resistance varieties



Objective

1. Study variation in resistance to CMD
2. Effect of fertilizer application
3. Evaluate yield impacts on different varieties

Variety	Origin	Genetic background
KU50	Thailand	R 1 x R 90
Rayong 11	Thailand	R 5 x OMR 29-20-118
SC8	China	CMR38-120-10
HuayBong60	Thailand	R 5 x KU 50
KM98-1	Vietnam	R 1 x R 5
Rayong 5	Thailand	27-77-10x R3



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Experimental sites



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Healthy cassava crop 4 month growth

Healthy cassava crop 7 month growth

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Close to 100% infected field by 7 month



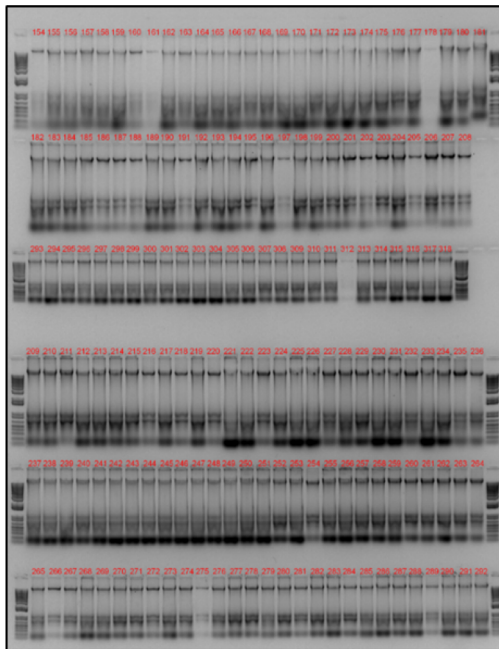
Disease Symptoms

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Measurements

1. Disease symptoms at 60, 150 and 270 DAP
2. Assess asymptomatic plants –presence or absence of virus
3. Yield and starch content



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CMD symptomatic plants after different time

Site 1

Site 2

KU50 (V1)									Rayong11 (V2)									SC8 (V5)									
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	
P1									P1	X	X	X	X		X	X	M	P1	X	x	X	X	x		X	X	X
P2	M		M	M					P2	X	X	X	X		X	X	M	P2	X	X	X	X	X		X	X	X
P3		M			M	M			P3	M	X	X	x		X	x		P3	X	X	X	X	M	X	X	X	
P4					M	M			P4	X	M	X	X		X	X	M	P4	x	X	X	X		M	X	X	x
P5	M		M						P5	X	X	X	M		X	X	M	P5	X	X	X	M	X	X	x	M	
P6									P6	X	X	X	X		X	X		P6		X	X	X	X	X	M	X	

Rayong11 (V2)									Rayong5									Hauybong								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	X	X			X	X	X	X	P1			X	M					P1		X						M
P2	M		M		X	X	X		P2						M	X		P2	X	X	X	X	X	X	X	M
P3	X	X	X						P3						M		M	P3	X	X	X	M	X	X	X	M
P4	X	X	X	M		M			P4	X						X	M	P4	X	X	X	X	X	X	X	M
P5	X			X	X	X			P5							X	M	P5	X	X	X	X	X	X	X	M
P6			M						P6		X	X	x	M	X	X		P6	X	X	X	X	X	X	X	M

Hauybong60									KU50 (V1)									Rayong5								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1			X	M			M	M	P1									P1								
P2	M				M	M	M		P2	M							X	P2		M						
P3	M			M	M	M			P3	M			M					P3	M			M				
P4	M	M	M	M		M			P4		M				X	X		P4		M		M	X	X	X	
P5	M	M	X		X	M			P5	M								P5	X	M	X	X	X	X	X	M
P6	M	M			M	M		M	P6						X		X	P6								X

Rayong5									SC8 (V5)									KM 98-1 (6)								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1			X						P1	X	X	X	X		X			P1	M							
P2			X						P2	x	X	X	X		X	X	X	P2			M				M	
P3					X				P3	X	M	X	X		X	X	X	P3							M	X
P4		X							P4	M	X	X	X	X		X		P4			X	M				X
P5									P5	M	x	X	X	X	X	X	X	P5	M							
P6			M	X			M		P6	X	M	X	M	x	X	X	X	P6	M	M						

SC8 (V5)									KM 98-1 (6)									KU50 (V1)								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	x	X		X	X	M	X	X	P1								M	P1	M	M			M	M	M	
P2	X	X	X	X	X	X	X	X	P2		X	M						P2		M	M		M	M	M	
P3	x	X	X	X	X	X	X	x	P3		X	M	M					P3				M		M	M	
P4	M	X	x	X	X	X	X	X	P4			x					M	P4	M				M	M	M	
P5	X	X	X	X	X	X	X	x	P5									P5	X		M		X	X	X	
P6	M	X	M		X	X	X	X	P6	X								P6					M		M	

KM 98-1 (6)									Hauybong60									Rayong11								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1									P1	M								P1		x	X				X	
P2									P2				M					P2	X	X	X	X	X	X	M	
P3									P3	M	M							P3	M	X	M	M	M	X	M	
P4			X						P4	M	M	M						P4	X	X	X	X	X	M		
P5									P5		M	M						P5	M	M	X	M				
P6	X	M	M		X	X	M		P6	M	M							P6	M	X	X	X	M	X	X	

KU50 (V1)									Rayong11									SC8 (V5)								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1		X		x		M	X	X	P1	x	X	X	X	X	X	X	X	P1	X	x	X	X	X	M	X	X
P2	X	X	X	M	X	X	X		P2	x	X	X	X	X	X	X	X	P2	X	X	X	X	X	M	X	M
P3	M	X			X	X	M	X	P3	x	X	X	X	X	X	X	X	P3	x	X	X	X	X	X	X	M
P4		M	M	X	M	X			P4	x	X	X	X	X	X	X	X	P4	X	X	X	M	X	X	X	M
P5									P5	X	X	X	X	X	X	X	X	P5	X	M	X	X	X	X	X	M
P6		M	X	M	X	X	X	X	P6	X	X	X	X	X	X	X	X	P6	X	X	X	X	X	X	X	M

Rayong11 (V2)									Rayong5									Hauybong								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	M	x	X	X	X	X	X	X	P1	X		X	M		X	X	X	P1		X						M
P2	x	X	X	X	X	X	X	X	P2	X	X	X	X	X	X	X	X	P2	X	X	X	X	M	X	X	M
P3	x	X	X	X	X	X	X	X	P3	X	X	X	M		X	X	X	P3	x	X	X	X	X	X	X	M
P4	x	X	X	X	X	X	X	X	P4	x	X	X	X	X	X	X	X	P4	X	X	X	X	X	X	X	M
P5	x	X	X	X	X	X	X	X	P5	X	X	X	X	X	X	X	X	P5	X	X	X	X	X	X	X	M
P6	x	X	X	X	X	X	X	X	P6	X	X	X	X	X	X	X	X	P6	X	X	X	X	X	X	X	M

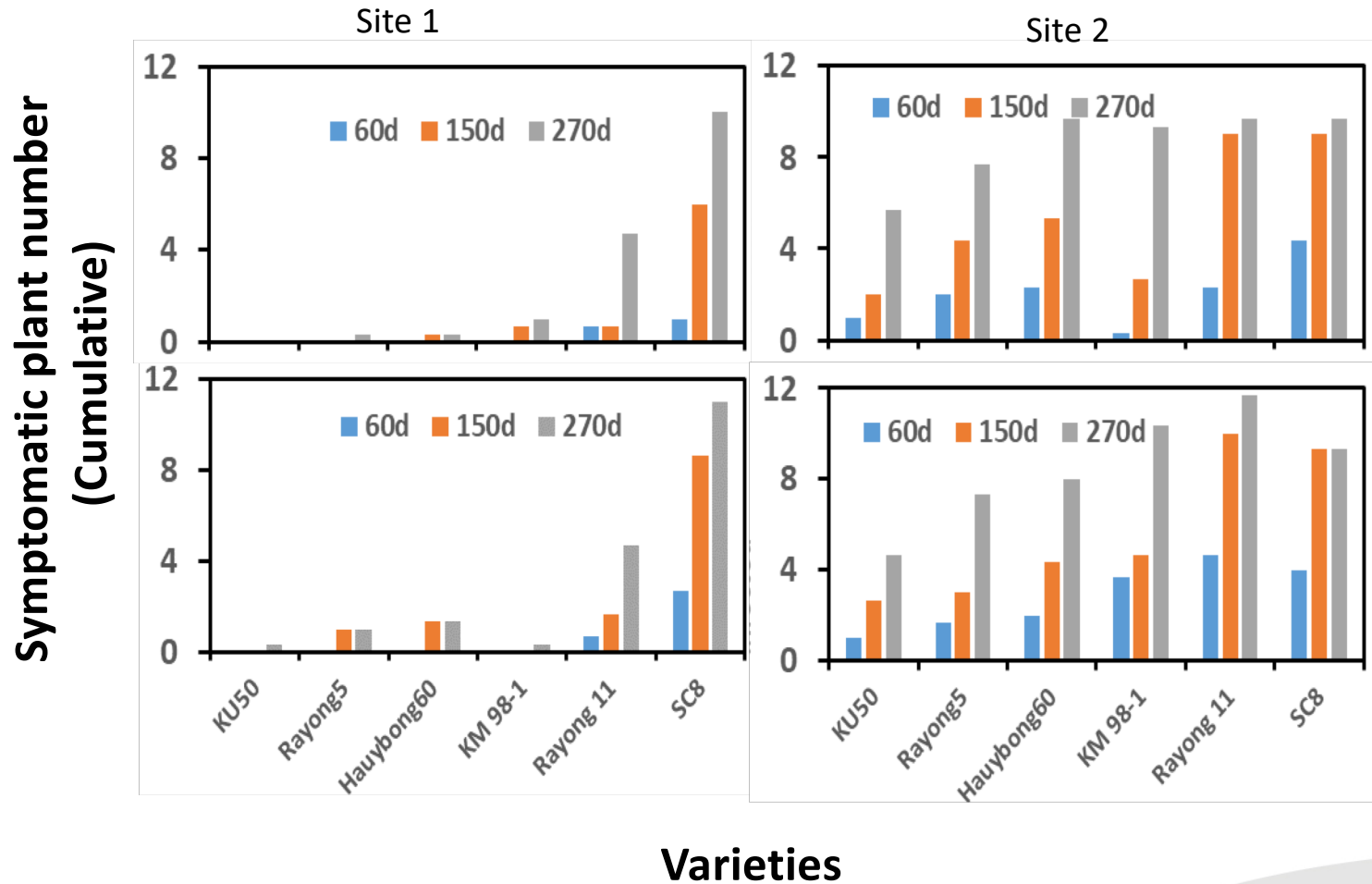
Hauybong60									KU50 (V1)									Rayong5								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	X	X	X	X	X	X	X	X	P1	M	X	X	X	X	X	X	X	P1	X	X	X	X	X	X	X	M
P2	X	X	X	X	X	X	X	X	P2	X	X	X	X	X	X	X	X	P2	X	X	X	X	X	X	X	M
P3	x	X	X	X	X	X	X	X	P3	X	X	X	X	X	X	X	X	P3	X	X	X	X	X	X	X	M
P4	X	X	X	X	X	X	X	X	P4	X	M	M	X	X	X	X	X	P4	x	X	X	X	X	X	X	M
P5	X	M	X	X	X	X	X	X	P5	X	M	X	X	X	X	X	X	P5	x	X	X	X	X	X	X	M
P6	x	X	X	X	X	X	X	X	P6	X	X	M	X	M	X	X	X	P6	X	X	X	X	X	X	X	M

Rayong5									SC8 (V5)									KM 98-1 (6)								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	X		M	M	X	X	X	X	P1	M								P1	X	x	X	X	X	X	X	M
P2	X	M		x	M	X	X	X	P2	X	x	X	M	x	X	X	X	P2	X	X	X	X	X	X	X	M
P3	X	X	M	X	X	X	X	X	P3	X	M	X	x	x	M	X	X	P3	M	X	X	X	X	X	X	M
P4	x	M	X	X	X	X	X	X	P4	x	M	X	X	X	X	X	X	P4	X	X	X	X	X	X	X	M
P5	x	x	x	M	X	X	X	X	P5	x	x	x	M	M	X	X	X	P5	X	X	X	X	X	X	X	M
P6	M	X	X	X	X	X	X	X	P6	M	X	X	M	X	X	X	X	P6	x	x	M	X	X	X	X	M

SC8 (V5)									KM 98-1 (6)									KU50 (V1)								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5	R6	R7	R8	R9
P1	X	M	x	x	X	X	M	X	P1	X	x	X	X	X	X	X	X	P1	X	X	X	X	X	X	X	M
P2	x	X	X	X	X	X	X	X	P2	x	X	X	X	X	X	X	X	P2	x	X	X	X	X	X	X	M
P3	x	X	X	X	X	X	X	X	P3	x	X	X	X	X	X	X	X	P3	X	X	X	X	X	X	X	M
P4	x	x	M	x	X	X	M	M	P4	x	X	X	X	X	X	X	X	P4	X	M	X	X	X	X	X	M
P5	x	X	X	X	X	X	X	M	P5	x	X	X	X	X	X	X	X	P5	X	X	M	X	X	X	X	M
P6	x	x	X	X	X	X	X	X	P6	x	X	X	X	X	X	X	M	P6	x	X	X	X	X	X	X	M

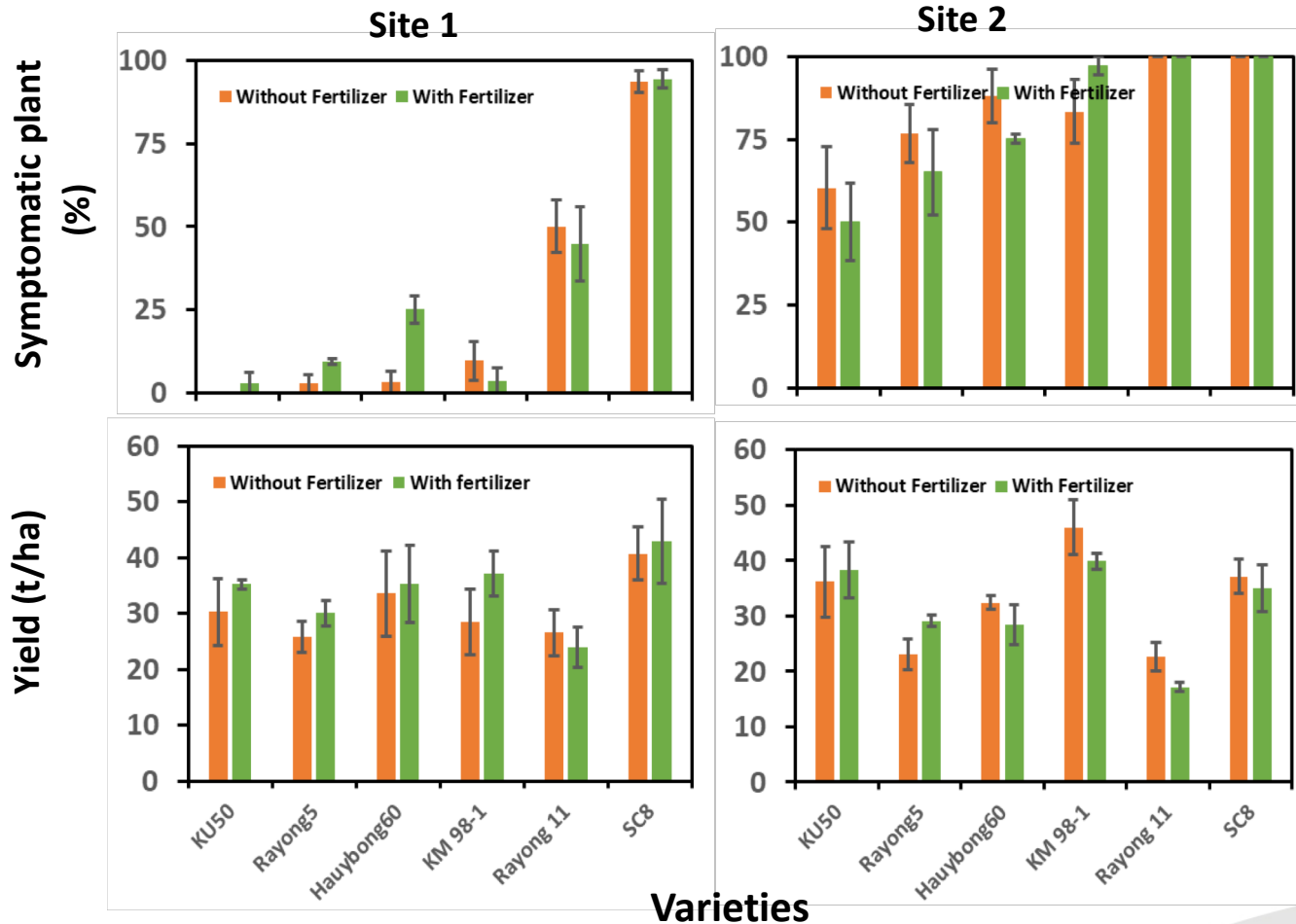
KM 98-1 (6)									Hauybong									Rayong11								
R1	R2	R3	R4	R5	R6	R7	R8	R9	R1	R2	R3	R4	R5</													

Number of CMD symptomatic plants



Number of CMD symptomatic plants increased with time

CMD symptomatic plants and impact on yield



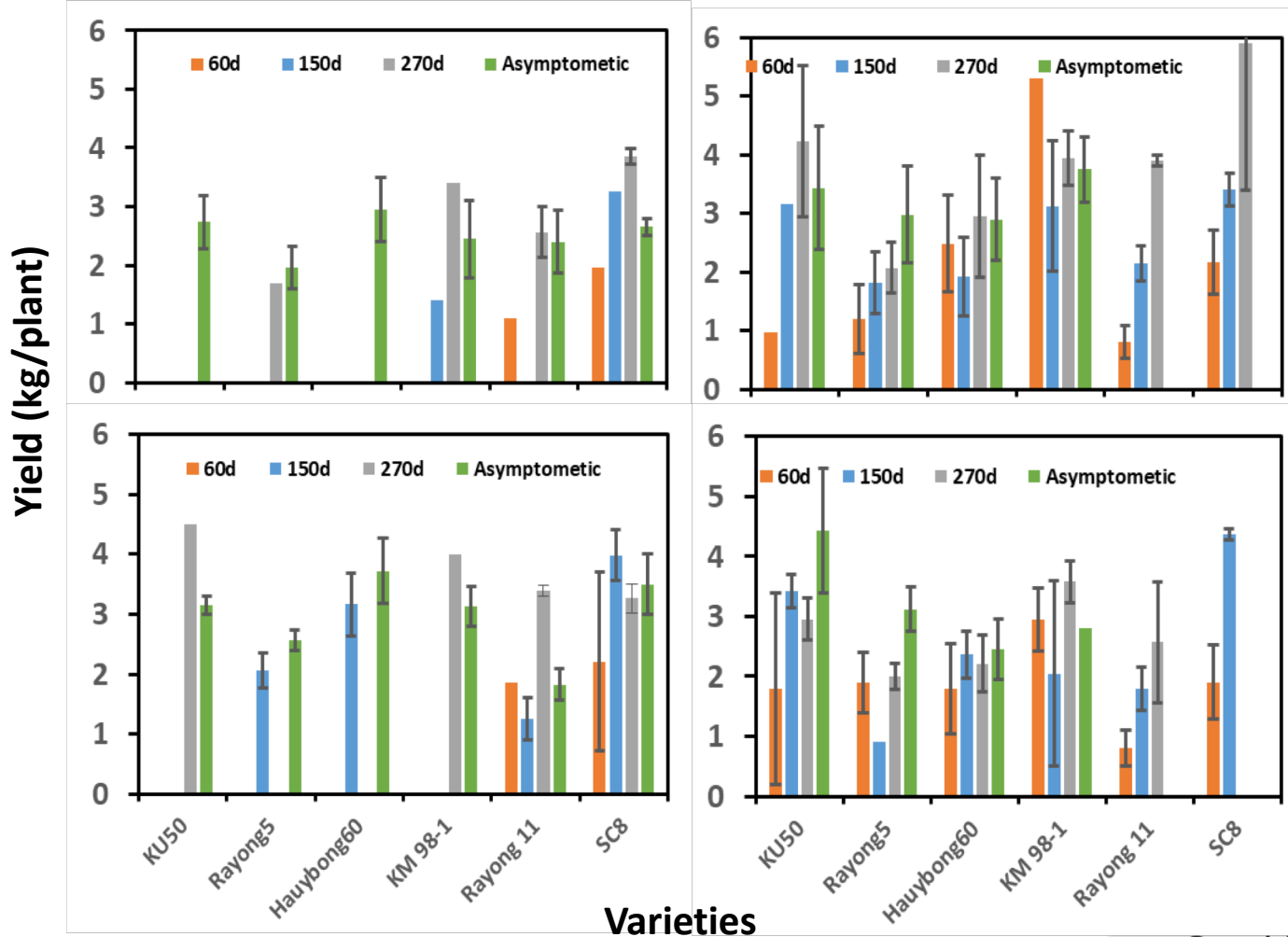
No effect of fertilizer on disease severity

Variety SC8 yielded highest in both treatment at site 1, however, in site 2 KM 98-1 produced highest. Rayong 11 yielded lowest in both treatment and both site.

Early infection reduces yield

Site 1

Site 2



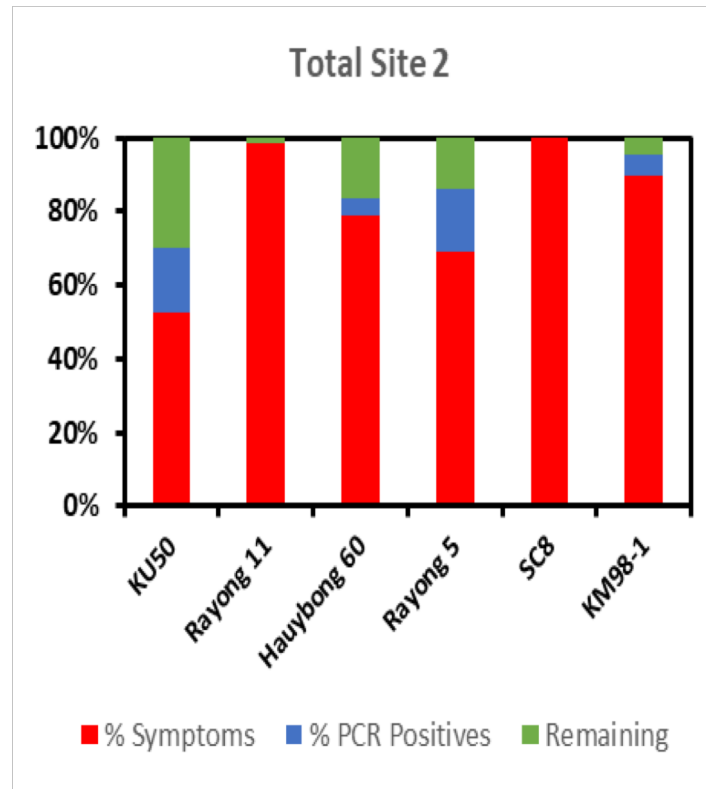
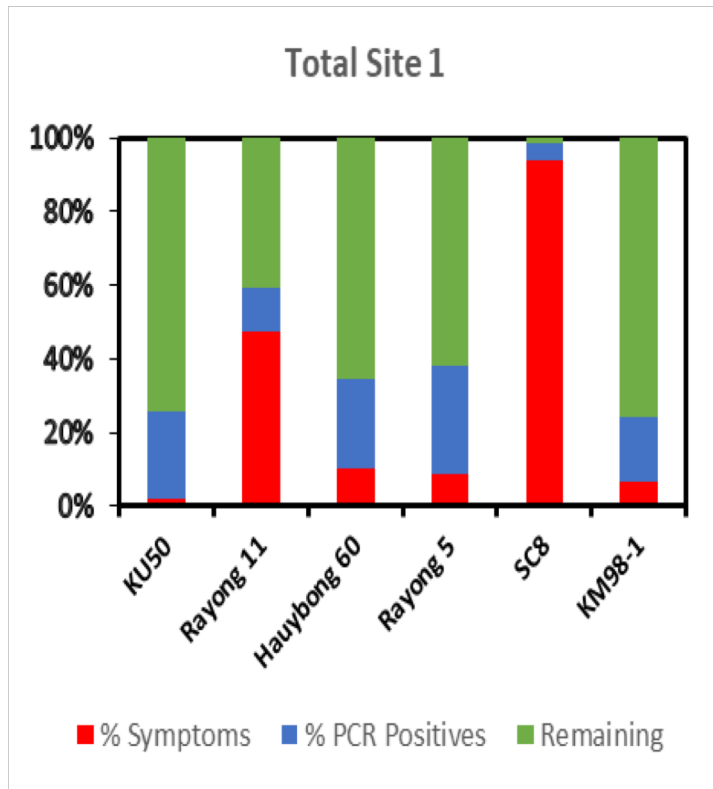
At 60 DAP produced on an average 1.5 to 2.2 kg/plant

At 270 DAP and/or asymptomatic plants produced 2.5 to 3.8 kg/plant

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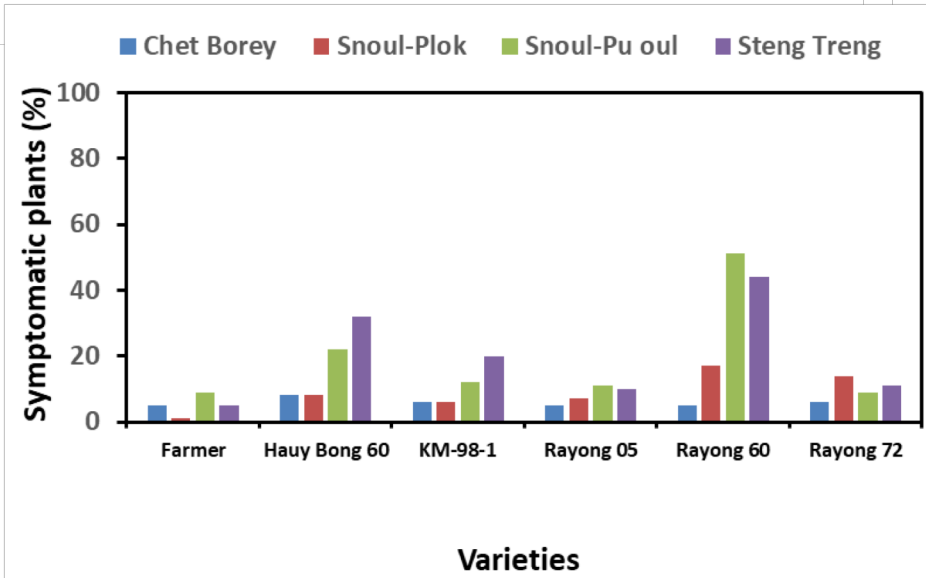
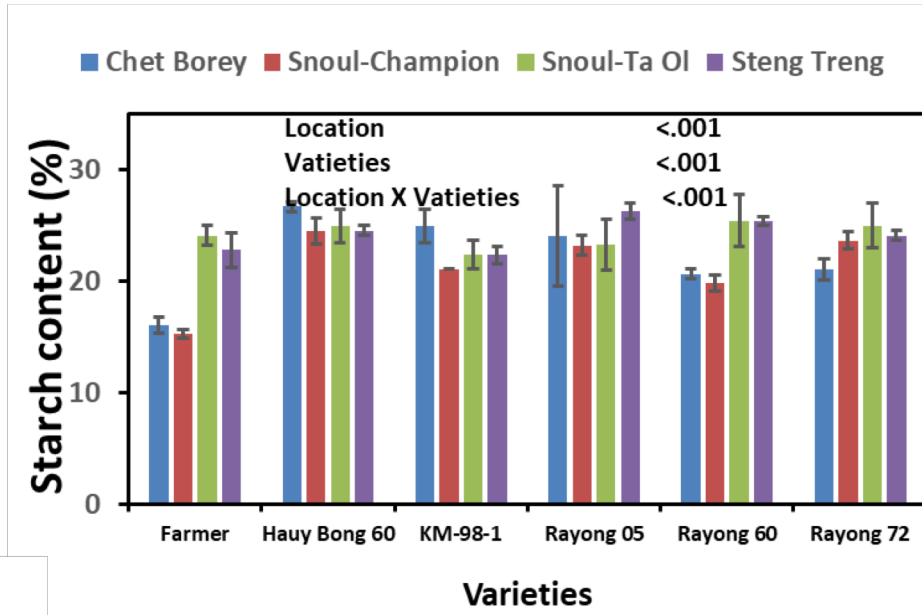
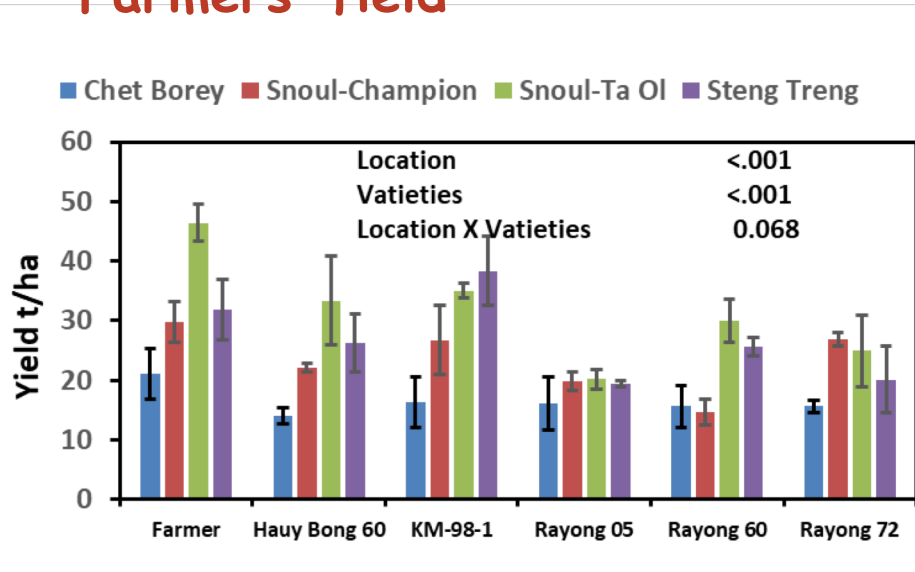


Disease symptoms and PCR positive for CMD of asymptomatic plants



PCR detected presence of virus in asymptomatic plants

Farmers' field



Infected planting material from trader at Snoul Ta Ol

Yield (t/ha) 18.5 ± 2.7

Average for all varieties = 31.6 t/ha

Farmer variety 46.4t/ha

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Scenario

Avoid 15t/ha lost @ 340 KHR/kg = 5,100,000 (\$1,275 USD)

Thai Stems = 12,000/ bundle = 1,200,000 KHR/ ha

MRR – 325%

If farmer manages to keep material clean:

Sell 800 bundles x 8,000 KHR = 6,400,000 (\$1,600)

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Field day with government, industry development organisation and farmers



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Conclusions

- Some variation in disease susceptibility was observed
- Early infection can lead to crop failure
- Clean plating material can produce profitable yield during first year of infection
- Positive selection has its risks

Acknowledgements

- GDA-MAFF
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