



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

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Outline

- Present the results of trials in 2017-19 and also 2018-19
 - Varieties
 - Fertiliser application
 - Intercropping
- Agronomic results
- Economic analysis
- Observations and future plans (2019-20)

- Implications of results will be presented tomorrow.



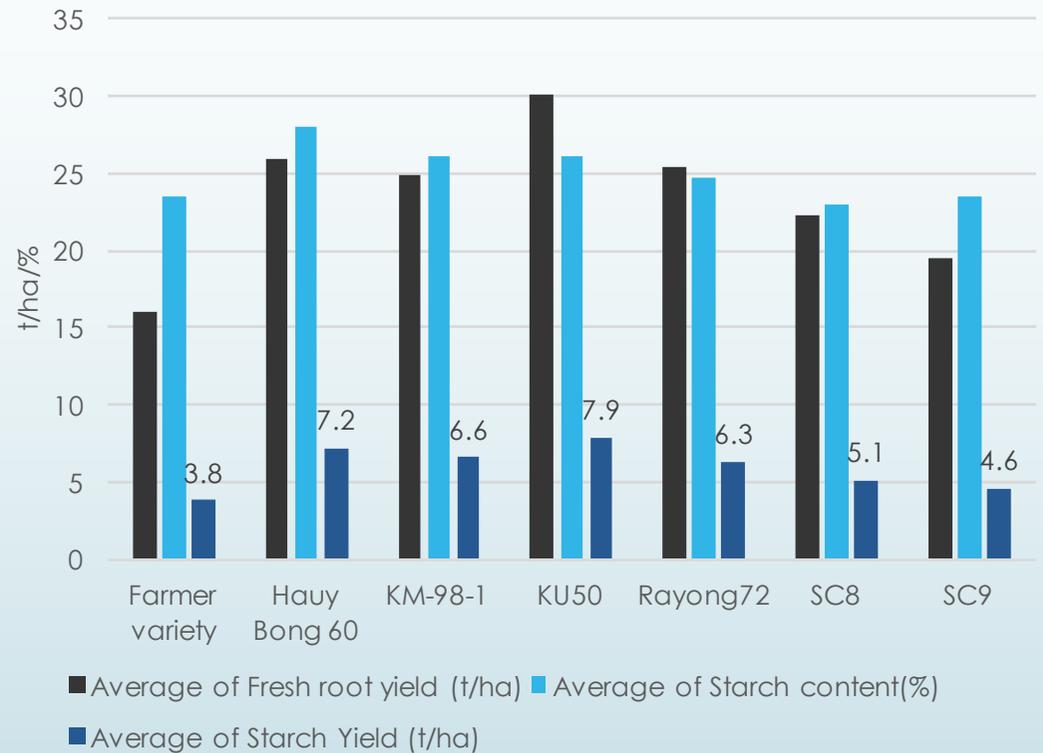
Variety trial 2017-18



Results impacted by disease

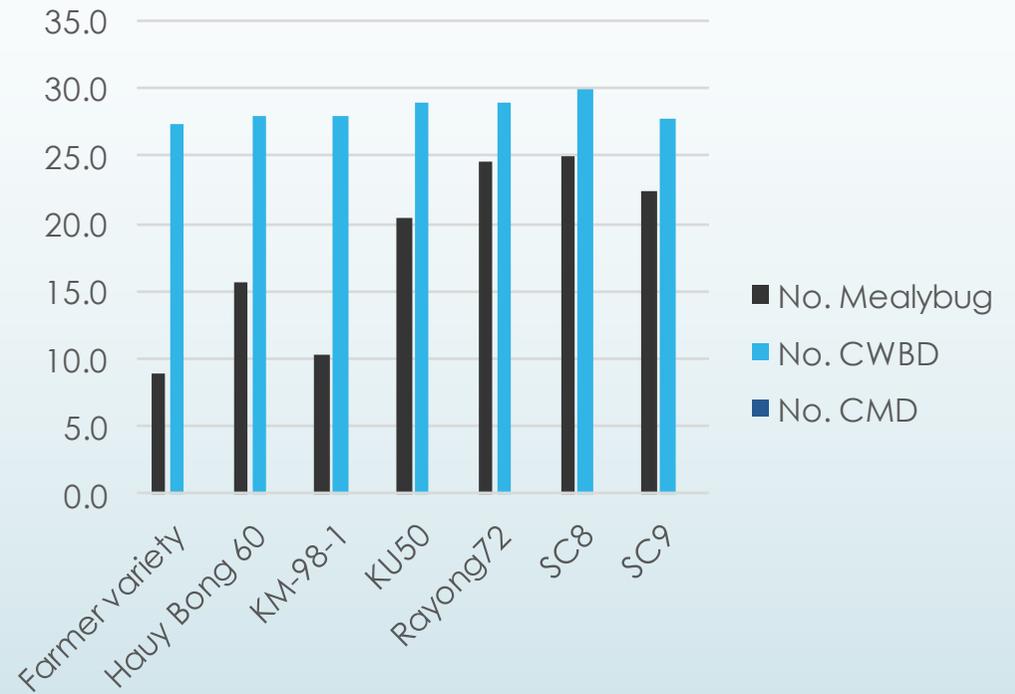
- Problem with farmers harvesting trials early so only 1 site remained for harvest by team.

Variety	Fresh root yield
KU50	30.17 a
Hauy Bong 60	25.94 ab
Rayong72	25.41 ab
KM-98-1	24.91 abc
SC8	22.29 abc
SC9	19.44 bc
Farmer variety (likely KM419)	15.97 c



Average number of plants infected by pest and disease at time of harvest in Snuol

- High rate of CWBD across all varieties
- No CMD observed in 2017-18 season in Snuol trial location.



Percentage of plants without visible symptoms



Variety	Infection rate (%)		Asymptom rate (% of infected)	
	Location		Location	
	1	2	1	2
Huay Bong 60	6.7	0.0	100	0.0
KM98-1	6.7	5.6	100	100
KU50	0.0	0.0	0.0	0.0
Farmer's Local Variety	76.7	88.9	26.1	20.0
Rayong 72	43.3	61.1	84.6	81.8
SC8	16.7	27.8	80.0	60.0
SC9	16.7	66.7	40.0	58.3

Asymptomatic plants

- **SC8/SC9** showed high levels symptoms by November 2017
- **Rayong 72** was still not showing high levels of symptoms by the second inspection despite high levels indicated with PCR

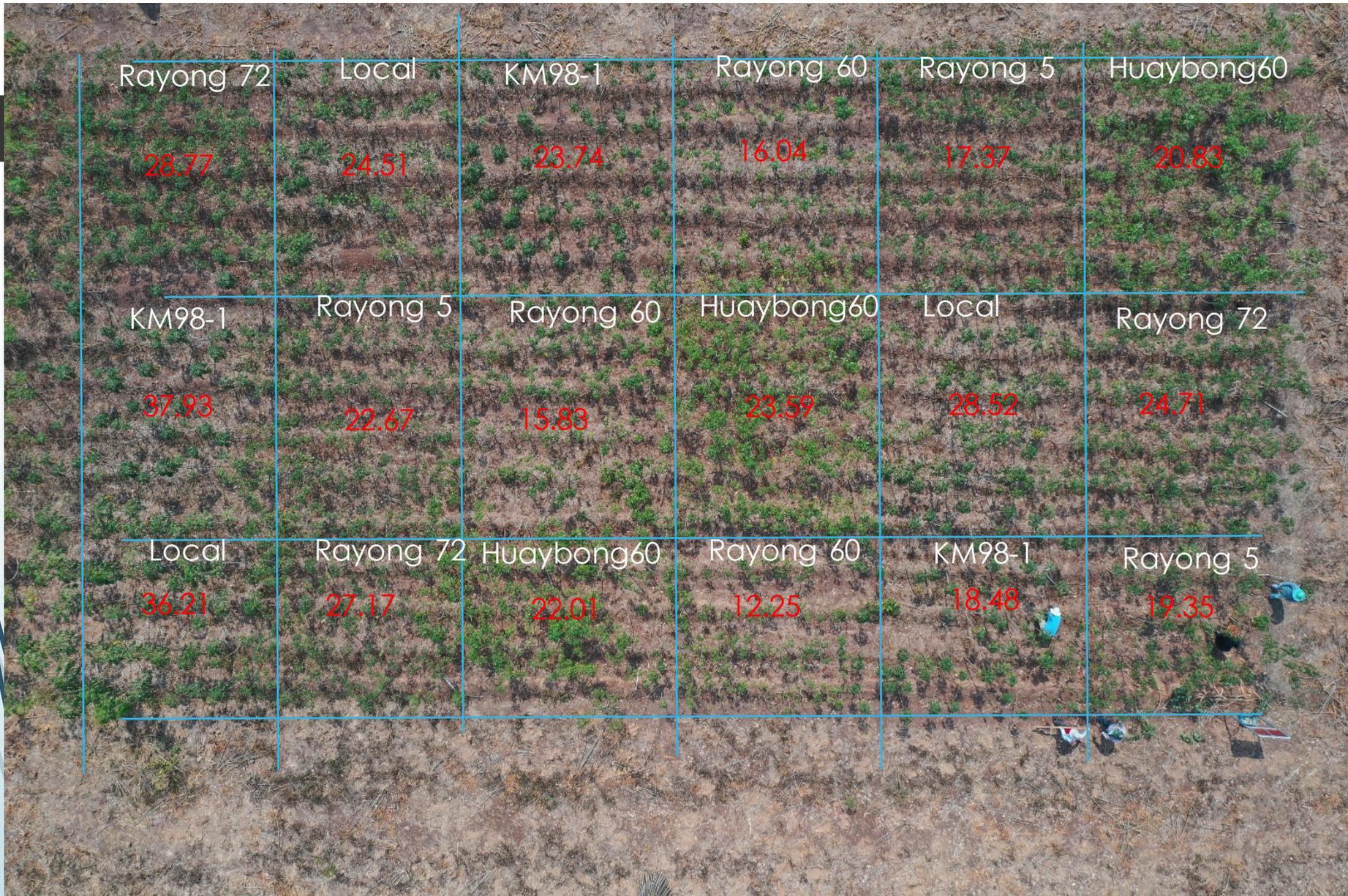
* DNA fingerprinting suggest SC8 and SC9 in the trial were the same variety.



Variety trial 2018-19



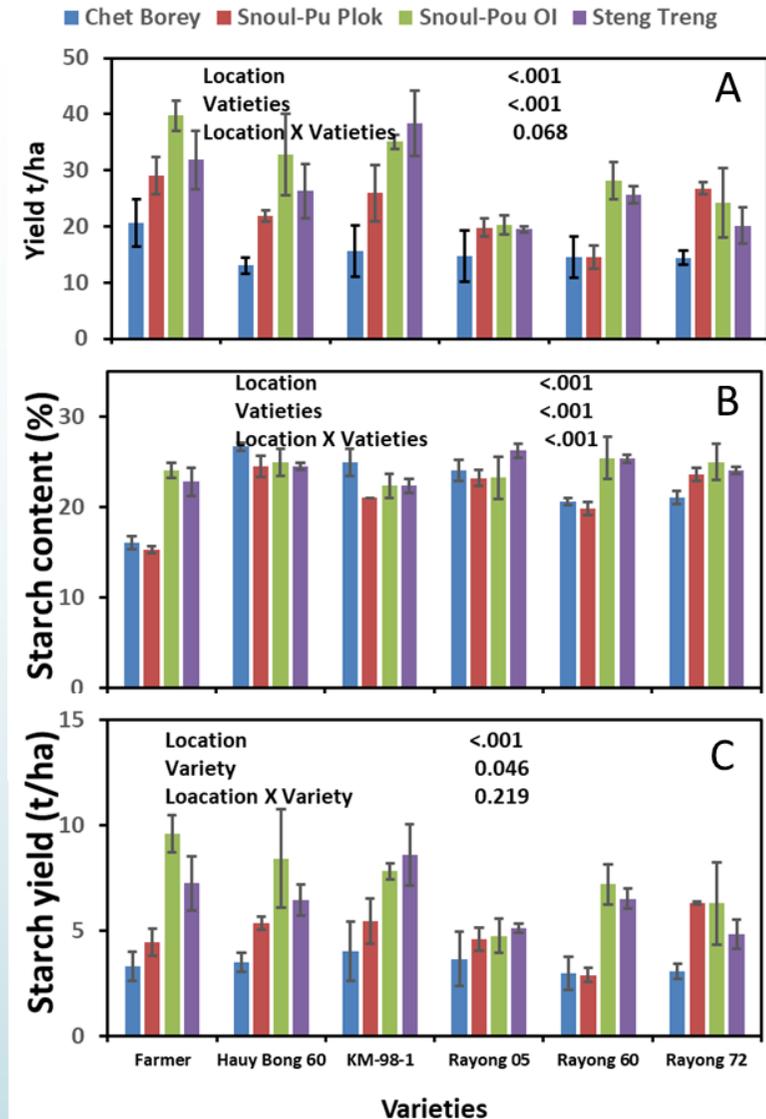




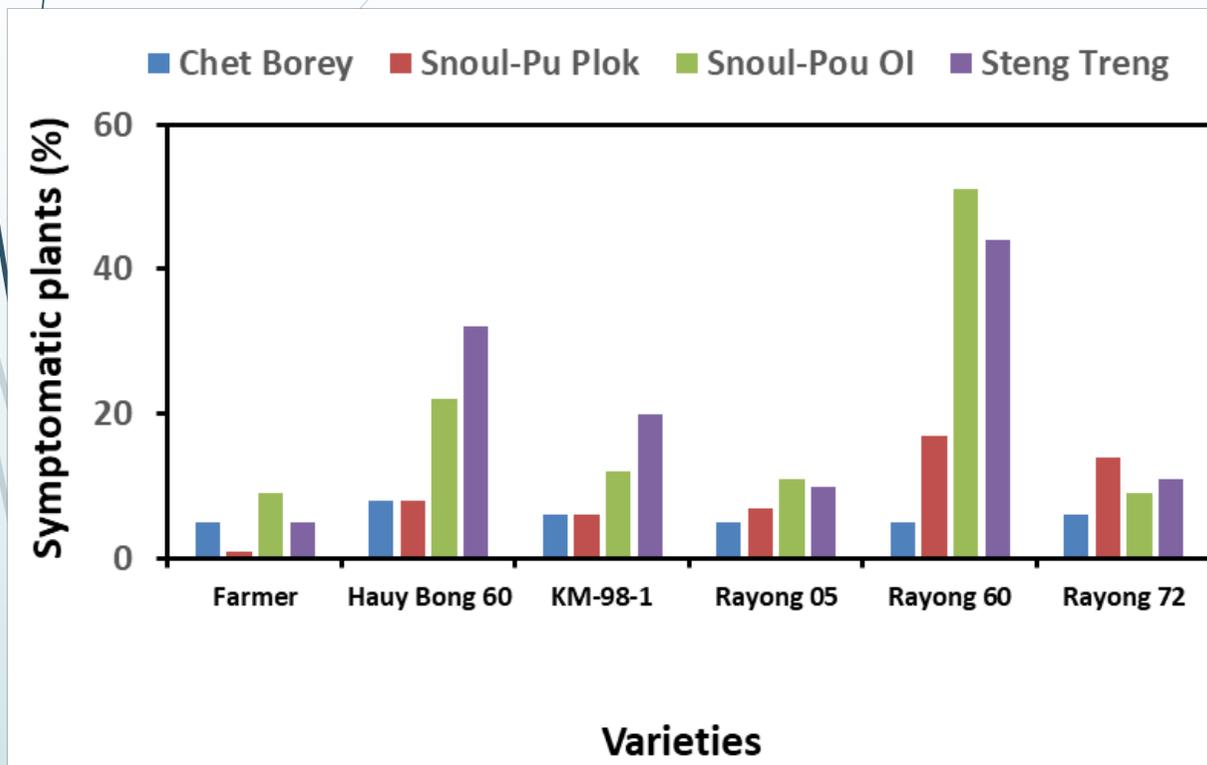


Agronomic results

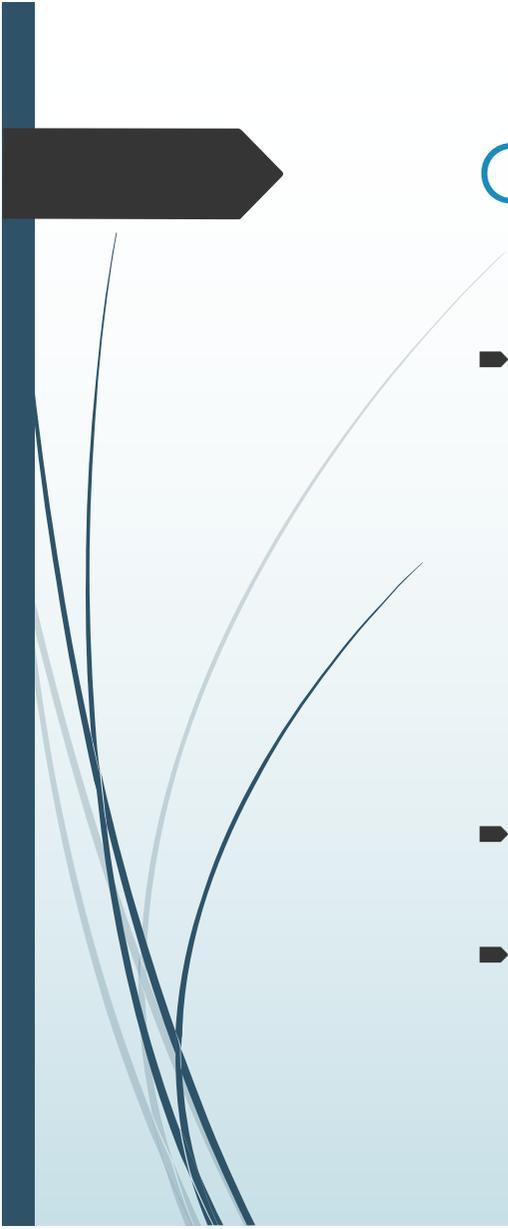
- Among the varieties across all locations farmer's choice variety yielded highest, ranged from 20.6 to 39.7 t ha⁻¹ and Rayong 5 yielded lowest, ranged from 14.8 to 20.2 t ha⁻¹.
- While considering different locations, on an average for all varieties Snoul-(Pou OI) produced highest (i.e. 30 t ha⁻¹) and Chet borey produced the lowest (15 t ha⁻¹)
- Starch content was significantly different at variety x location interaction (p < 0.001).
- On an average across all locations starch content of Hany Bong60 was highest (i.e. 25.2 %) and Farmers' choice variety had the lowest (i.e. 19.6%).
- However, starch yield was not significantly different at variety x location interaction (Fig 1C).



Observed CMD prior to harvest



- ▶ Number of CMD symptomatic plants differed among 6 varieties across **all locations**
- ▶ Percentage of CMD symptomatic plants was highest (i.e. 29.3%) for Rayong 60 and lowest for Farmer's choice variety (i.e. 5%).
- ▶ Among 4 locations percentage of CMD symptomatic plants were on average highest in trails Snoul-Pou Oi and Steng Treng for all the varieties, 20 and 19.3%, respectively.



Conclusion on varieties

- ▶ Ranking of varieties following the criteria of the fresh root yield and starch content came out very different-
 - ▶ FRY - Farmer's choice variety came out at the top; however,
 - ▶ Starch % the same variety came out at the bottom.
 - ▶ Although when ranking was calculated following starch yield farmer's choice variety came out as second preceded by variety KM98-1.
 - ▶ Ranking on the disease susceptibility (i.e. % of symptomatic plants), Farmer's choice variety ranked the top and Rayong 60 bottom.
- ▶ The current pricing system does not provide incentive for high starch content.
- ▶ It is assumed that stems in the trial were CMD free at time of planting. However other results have shown high levels of asymptomatic infection which would produce a different result in the following year.

Fertiliser trials 2017-18



Fertiliser use in NE Cambodia remained low in project villages.

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

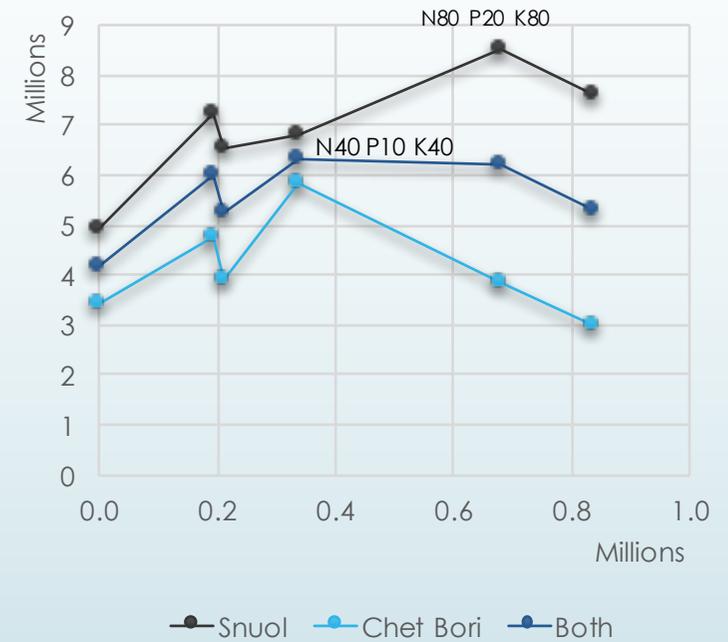
Agronomic results of fertiliser trial

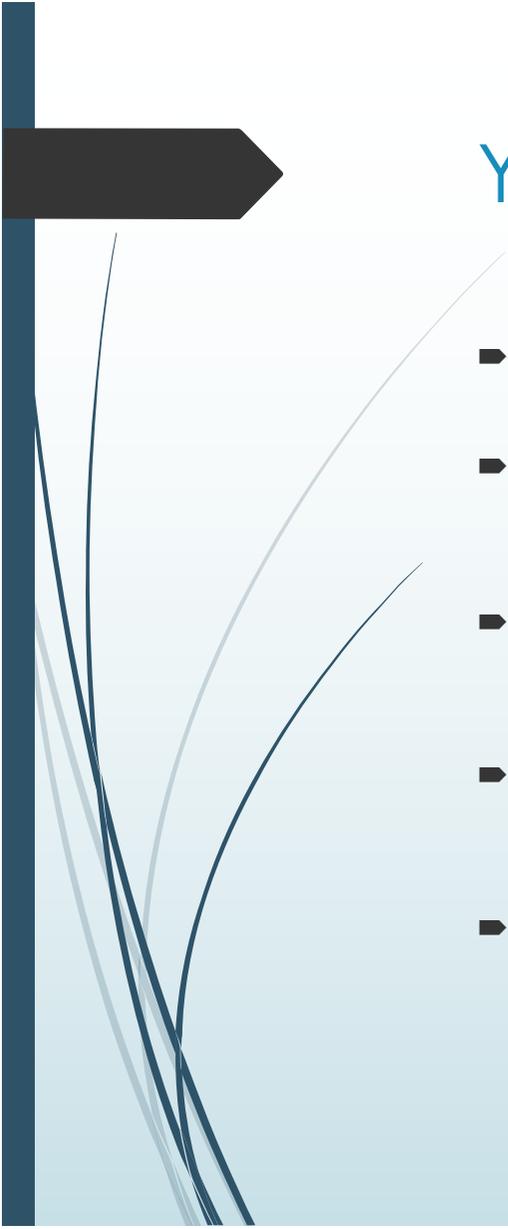
- ▶ Root yield was significantly different ($p < 0.001$) between two locations.
- ▶ However, there was no difference between the treatments in each location due to large variability caused by biotic (root rot, CMD and CWBD) stresses.
- ▶ The average fresh root yield was 1.4- to 2.2-fold higher in the Snoul District compared to Chit Borei District.
- ▶ The highest yield (26.3 ± 6.7 t ha⁻¹, Snoul) was achieved with highest fertilizer rate.
- ▶ In Chit Borei District highest yield was 17.6 ± 1.0 t ha⁻¹ with moderate fertilizer application.
- ▶ In general fertilizer application yielded higher fresh root compared to Farmers' practice and without any fertilizer application.

Treatment	Chit Borei (t/ha)	Snoul (t/ha)
Farmer practice*	11.8	19.3
N40 P10 K0	14.2	21.2
N40 P10 K40	17.6	20.3
N40 P10 K40 + CM 5T/ha	11	24.2
N80 P20 K80	12.9	26.3
No fertilizer	9.7	14
Fertilizer	P= 0.172, L.S.D.= 6.31	
Location	P<.001, L.S.D.=3.64	
Fertilizer x Location	P=0.403, L.S.D.=8.92	
*(20:20:15=100kg/ha)		

Net benefits and marginal rate of return analysis

Treatment	Cost of treatment	Snuol	Chit Borei	Both
No fertilizer	0	4,911,667	3,409,259	4,160,463
N40 P10 K0	191,987	7,224,124	4,779,309	6,001,717
Farmer practice (20:20:15=100kg/ha)	210,000	6,545,000	3,925,185	5,235,093
N40 P10 K40	338,661	6,774,117	5,818,746	6,296,431
N80 P20 K80	677,322	8,539,344	3,853,233	6,196,289
N40 P10 K40 +CM5T/ha	838,661	7,619,672	2,995,135	5,307,404



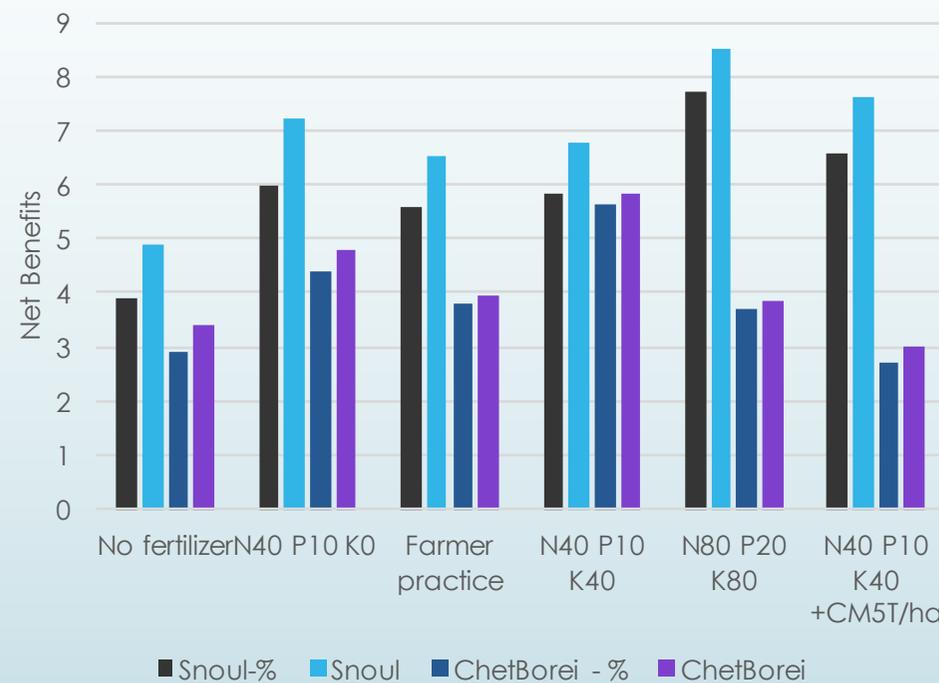
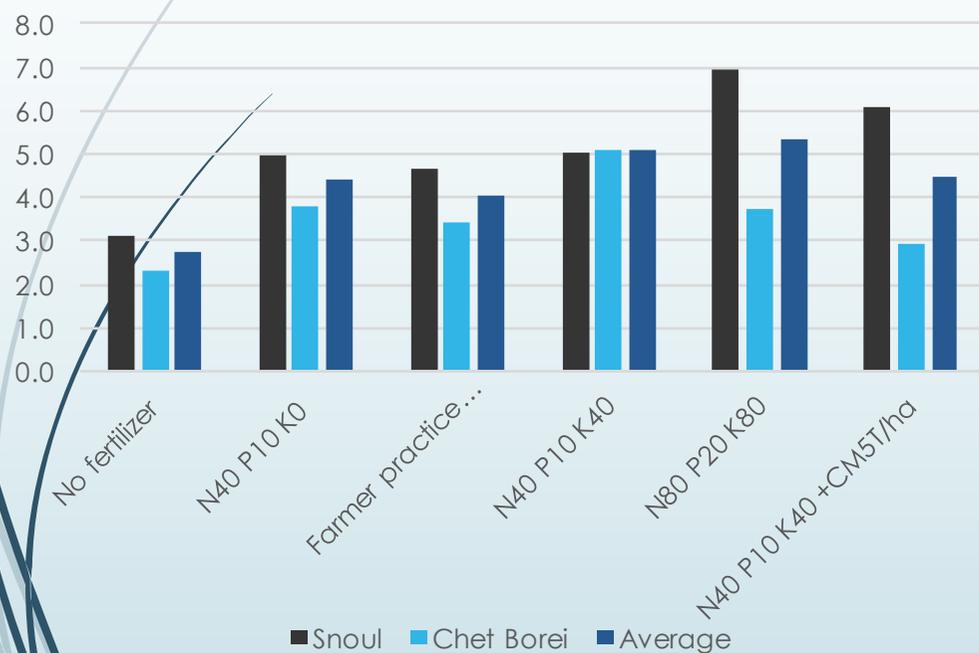


Year 1 conclusion

- Significant uncertainty surrounding fertiliser application when biotic and abiotic stresses are present.
- Given that there was no significant difference between fertiliser rates, the least expensive rate would be recommended, however given it is only one year of result no recommendation can be safely made.
- If average responses are considered, a \$50 USD investment in fertiliser produced a marginal net benefit (MDB) of over \$570 for N40 P₂O₅10 K₂O 0. At all probable root prices the MRR would be above 200%.
- An additional \$120 USD investment (\$170 USD total) required for the high balanced rate produced a MNB of \$329 USD equivalent to a MRR of 270%. This would remain above 200% for prices above 280 Riel/kg (analysis done at 350 Riel).
- In Chet Bori District, once again the cheapest rate (N40 P₂O₅10 K₂O 0) produced a high MRR (714%), while the additional of potassium (N40 P₂O₅10 K₂O 40) also produced a high MRR (709%).

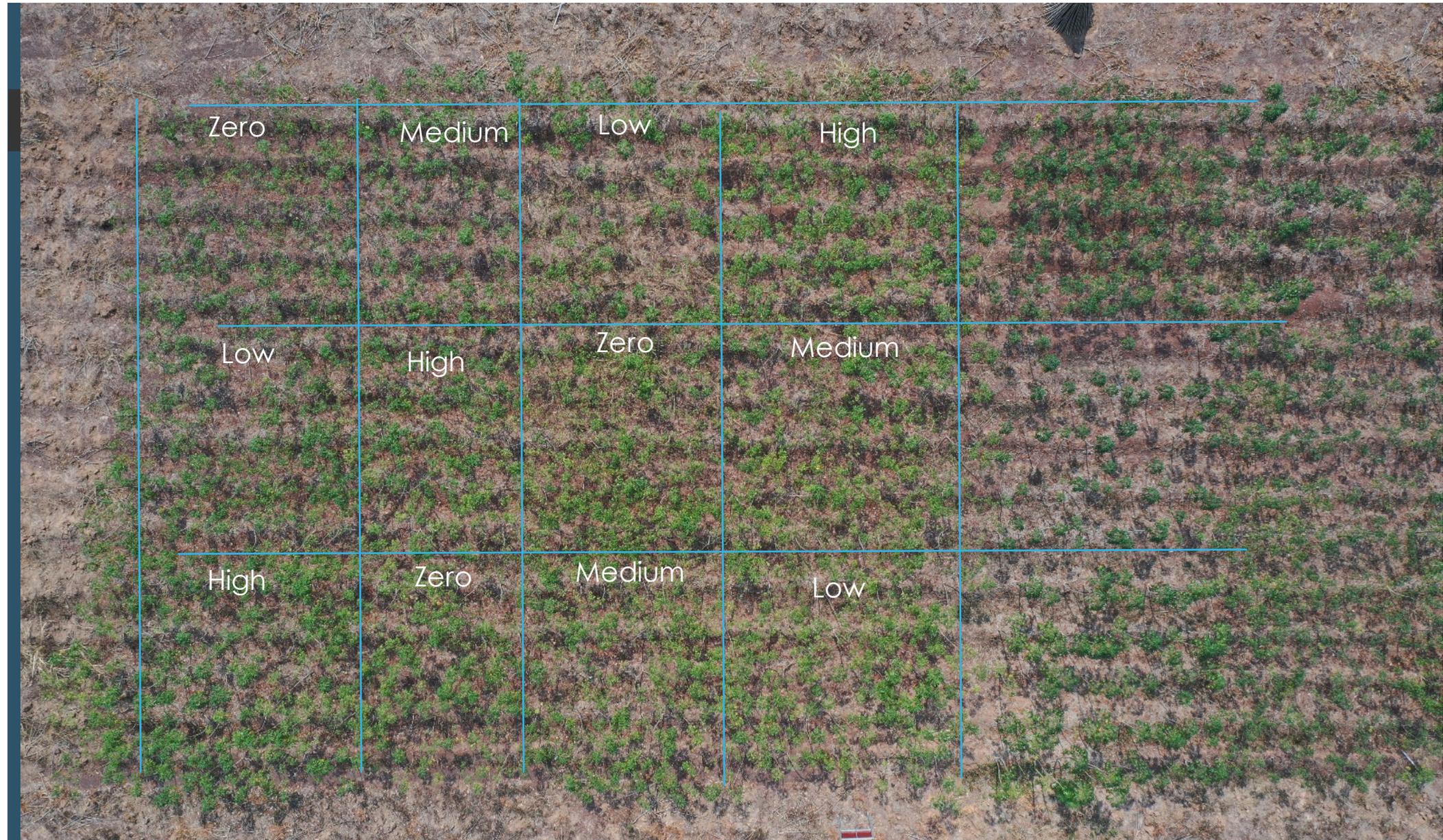
Impact on starch content & starch yield

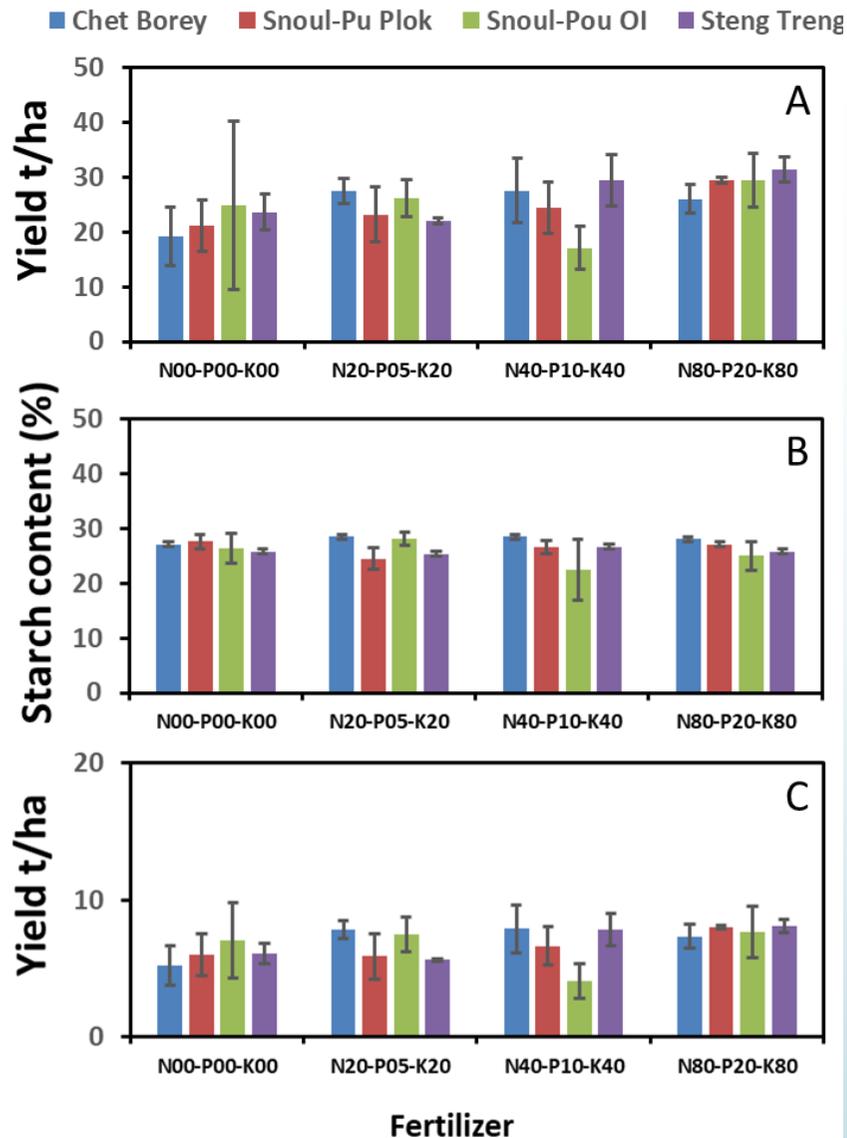
- Application of fertilizer increased starch content in all treatments ranged
- This becomes more important when prices are paid on starch content



Fertiliser trial 2018-19



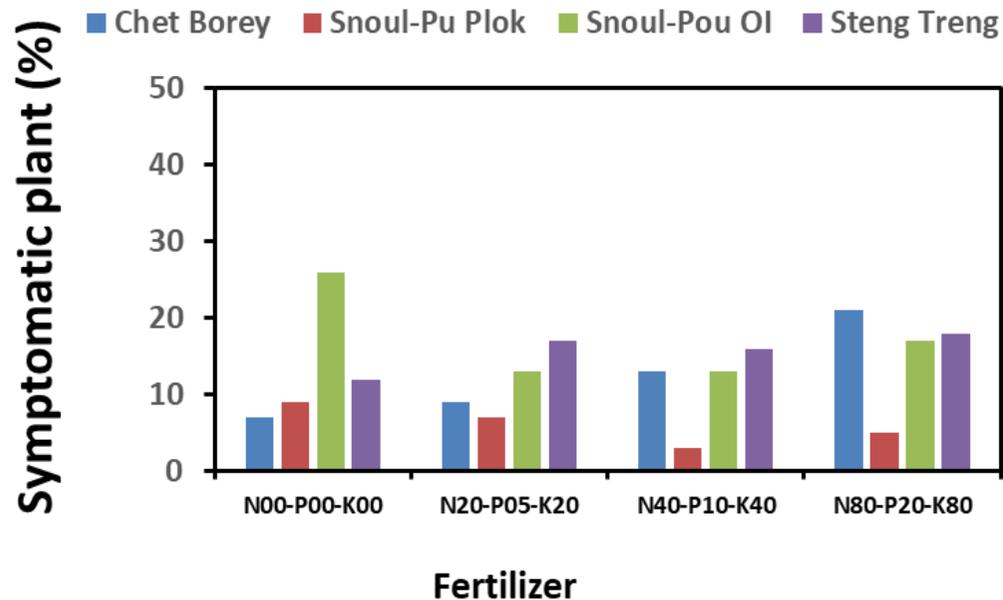




Fertiliser agronomic results

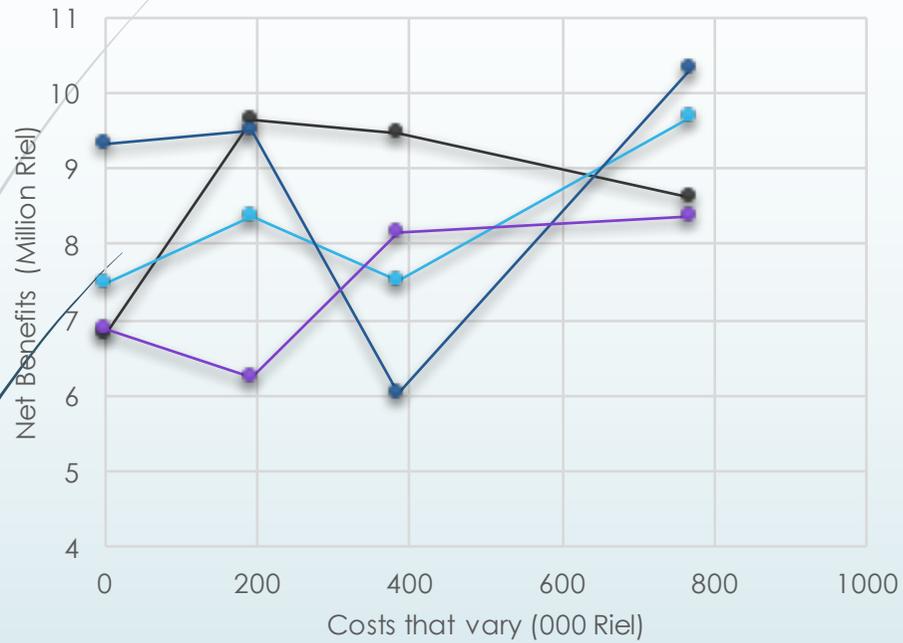
- Fresh root yield was not significantly affected by the location x treatment interaction because fertilisation treatment responded similarly across treatment and location (Fig 3A).
- However, highest fertilizer treatment (i.e. 80N-P20-K80) produced highest (29 t ha^{-1}) and no fertilizer application produced the lowest (22 t ha^{-1}) fresh root yield on average of all locations which is an increase of yield by 1.3 fold.
- Yield increase by 1.13-fold was observed at minimum fertilizer (20N-P05-K20) application compared to no fertilization on an average of all location.
- Highest yield increase was 1.45-fold at Chet Borey when applied minimum fertilizer (20N-P05-K20) compared to no fertilization.
- Starch content and Starch yield was not significantly affected by the location x treatment interaction (Fig 3B and C).

Did fertiliser effect the appearance of CMD symptoms?

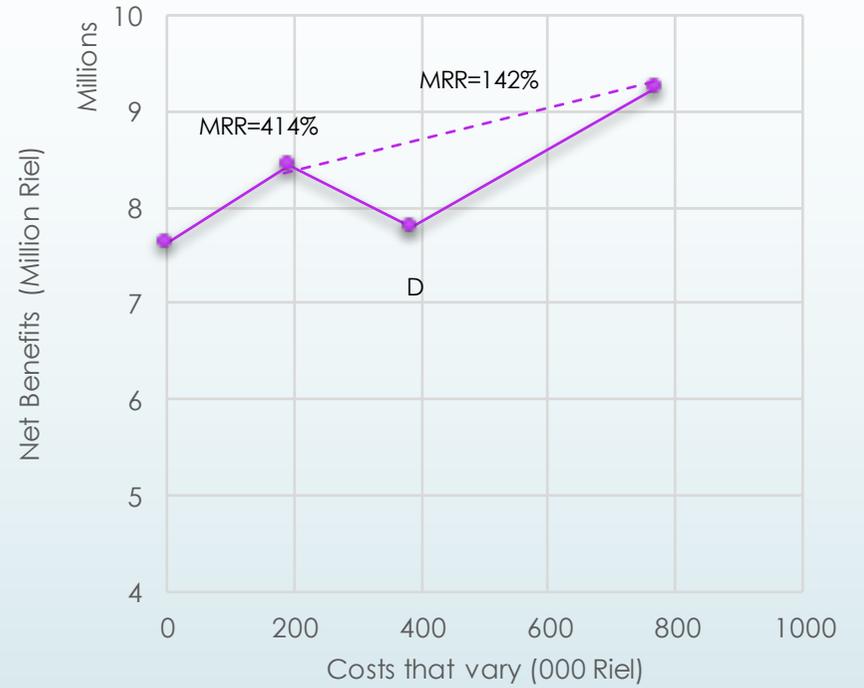


- Number of CMD symptomatic plants did not differ when compared across all locations and all fertilizer treatments (ranged ~11 to 15 %)
- There was no clear trend in percentage of symptomatic plants considering different fertilizer treatment.

Economic results



● Chet Borey ● Snoul-Champion
 ● Snoul-Ta OI ● Steng Treng



● Average

Impact of CWBD



Impact on farmer incomes of price and yield

Snoul District, Kratie

	Root price (Riel/kg)		
Yield (t/ha)	80	240	340
10	-1,265,000	335,000	1,335,000
15	-865,000	1,535,000	3,035,000
20	-465,000	2,735,000	4,735,000

Chet Borei District, Kratie

	Root price (Riel/kg)		
Yield (t/ha)	60	230	360
5	-2,230,000	-1,380,000	-730,000
10	-1,930,000	-230,000	1,070,000
20	-1,330,000	2,070,000	4,670,000
30	-730,000	4,370,000	8,270,000



	Snoul (Champion)		Chet Borei	
	Without fertiliser	With fertiliser	Without fertiliser	With fertiliser
Material costs (A)	1,070,000	1,840,480	1,830,000	2,023,320
Labour costs (B)	755,000	795,000	700,000	740,000
Total costs (A+B = C)	1,825,000	2,635,480	2,530,000	2,763,320
Revenue (D)	7,484,681	10,463,934	6,810,882	9,821,436
Net returns (D-C)	5,659,681	7,828,454	4,280,882	7,058,116
Gross Margin (USD)	1,415	1,957	1,070	1,765
Net returns to household resource (D-A = E)	6,414,681	8,623,454	4,980,882	7,798,116
Labour days (F)	32	34	23	25
Net returns per labour day (E/F)	200,459	253,631	216,560	311,925
Low price scenario				
Revenue	2,138,480	2,989,696	1,945,966	2,806,124
Net returns	313,480	354,216	-584,034	42,804
Gross Margin (USD)	78	89	-146	11
Net returns to household resource	1,068,480	1,149,216	115,966	782,804
Labour days	32	34	23	25
Net returns per labour day	33,390	33,800	5,042	31,312
Net returns per labour day (USD)	8.35	8.45	1.26	7.83

Transition to tree crops

- ▶ Farmers in some locations transitioning to tree based systems and show limited interest in investing in their cassava



Farmer response

- ▶ Variety
 - ▶ Yield
 - ▶ Good big stakes
- ▶ Fertiliser
 - ▶ Yield
 - ▶ Affordable cost
 - ▶ High return









Plan for 2019-2020

- ▶ KU50 variety vs farmer's choice variety
- ▶ Zero fertilizer vs lowest fertilizer rate
- ▶ 5 locations in Kratie

Thanks you

