Establishing sustainable solutions to cassava diseases in mainland Southeast Asia

Final Review Hung Loc Agricultural Research Center (HLARC)

Objective 4: Develop and evaluate economically sustainable cassava seed system models for the rapid dissemination of new varieties and clean planting material to farmers in different value chains and production contexts

Alliance









- Activity 1: The effects of water availability on cassava yield and starch accumulation.
- ✓ Activity 2: Effects Planting Density on cassava yield and starch accumulation
- ✓ Activity 3: Susceptibility of Cassava Varieties to Cassava Mosaic Disease Trial
- ✓ Activity 4: Rapid multiplication by tunnel system

Activity 1: The effects of water availability on cassava yield and starch accumulation (Dong Nai province).





Dr. Jochen Eberhard, Mr. Michael Scobie, Ms. Sarah Seton

- Centre for Agricultural Engineering, University of Southern Queensland
- International Climate Initiative (IKI), German Federal Ministry for the Environment

OBJECTIVES

- Evaluate the impact of supplemental irrigation water on yield and starch content of cassava plants.
- Optimize economic benefits in irrigated cassava production by choosing harvest time



I. MATERIAL AND METHOD

- Location: Hungloc Agricultural Research Center, Dongnai province
- Duration: 2019 2021
- Varieties: KM94 (a.k.a KU50) and D7
- Experimental design: Split-plots with 4 replications.
- Density: 1m x 0.8m (12,500 plants/ha).
- Recorded Indicators:
- ✓ The Length of Stem with and without green leaves (cm)
- ✓ The Fresh Stem and Leaves Yield (Tons/ha), Fresh Tubers Yield (Tons/ha), Harvest Index (%)
- ✓ Starch Content (%)



Fig 1. Land preparation (April 2020)

ep 1: Irrigation	Rep 2: Irrigation
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в	1	2	3	4	5	6	7	8	9	1 0	1	1 2	1	1 4	1 5	1 6	1 7	1	1 9	2	2	2	23	24	25	2 6	27	2	2 9	3 0	3	3	3	34	35	3	3 7	3	3 9	4 0	4	4	4	4	4 5	4 6	4	4
в	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1	1 4	1 5	1 6	1 7	1	1 9	2	2	2	23	24	25	2 6	27	2	2 9	3 0	3	3	33	34	35	3	3 7	3	3 9	4 0	4	4	4	4	4 5	4 6	4	4
		х					х					X					х					х					Х					Х					х					х					Х	
в	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1 3	1 4	1 5	1 6	1 7	1 8	1 9	2	2	2 2	2 3	2 4	2 5	2 6	2 7	2 8	2 9	3 0	3	3 2	3	3 4	3 5	3 6	3 7	3 8	3 9	4 0	4	4	4	4 4	4 5	4 6	4 7	4 8
в	1	2	3	4	5	6	7	8	9	1 0	1	1 2	1 3	1 4	1 5	1	17	1	1	2	2	2	23	2	25	2 6	27	2	2 9	3	3	3 2	3	3 4	3 5	3 6	3 7	3	3	4	4	4	4	4	4 5	4 6	4	4

Rep 3: NON-Irrigation

	Τ.								-																																							_
A	1	2	3	4	5	6	7 8	9	1	1	1 2	1 3	1 4	1 5	1	1 7	1 8	1 9	2 0	2	2	23	2	2 5	2 6	27	28	2 9	3 0	3	3 2	3	34	3 5	36	3 7	3	3	4 0	4 1	4	43	4	45	4 6	4 7	4 8	
A	1	2	3	4	5	6	7 8	9	1	1	1	13	1	15	1	1	1 8	1 9	2 0	2	2	23	2	2 5	26	27	2 8	2 9	3 0	3	3	3 3	3	3 5	36	3 7	3 8	3 9	4	4	4	4	4	4 5	4 6	4	4 8	
Α	1	2	3	4	5	6	7 8	9	1 0	1 1	1 2	13	1 4	15	1	1 7	1 8	1 9	2 0	2	2	2 3	24	25	26	2 7	2 8	2 9	3 0	3	3 2	3	3 4	35	3 6	3 7	3 8	3 9	4 0	4	4	4	4	4 5	4 6	4 7	4 8	
A	1	2	3	4	5	6	7 8	9	1 0	1 1	1 2	1 3	1 4	1 5	1	1 7	1 8	1 9	2 0	2	2	23	2	25	2 6	27	28	2 9	3 0	3	3 2	3	3 4	3 5	3	3 7	3	3	4	4	4	4	4	4 5	4 6	4	4	
в	1	2	3	4	5	6	7 8	9	1 0	1 1	1 2	1	1 4	1 5	1	1 7	1 8	1 9	2 0	2	2	23	24	2 5	2 6	27	2	2 9	3 0	3	3	3	3	3 5	3	3 7	3 8	3 9	4 0	4	4	4	4	4 5	4 6	4 7	4	
в	1	2	3	4	5	6	7 8	9	1 0	1 1	1 2	1	1 4	1 5	1	17	1 8	1 9	2 0	2	2	23	24	2 5	2 6	27	2	2 9	3 0	3 1	3 2	3	3	3 5	3	3 7	3 8	3 9	4 0	4	4	4	4	4 5	4 6	4	4	
					Τ																																											
в	1	2	3	4	5	6	7 8	9	1 0	1	1	13	1	15	1 6	1 7	1 8	1 9	2	2	2	23	24	25	26	2 7	2 8	2 9	3 0	3	3 2	3	3	3 5	36	3 7	3 8	3	4	4	4	4	4	4 5	4 6	4	4 8	
в	1	2	3	4	5	6	7 8	9	1	1	1 2	1	1 4	15	1	1 7	1 8	1 9	2 0	2	2	23	2	2 5	2	2 7	2	2 9	3 0	3	32	3	3 4	3 5	36	3 7	3	3	4	4	4	4	4	4 5	4 6	4	4	

3 4 5 6 7 8 4 5 6 7 8 3 3 3 3 3 3 4 4 4 5 6 7 8 9 0 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 3 7 8 9 0 1 2 3 4 5 6 7 8 9 0 3 3 3 4 5 6 7 1 2 2 9 0 1 1 1 2 2 8 9 0 1 9 0

	Soil moisture sensor
х	Sprinkler
	Non harvest
	Harvest 3
	Harvest 2
	Harvest 1
	TT 4 1

Fig 2. The Planting map

Re	ep	4:	In	rig	ati	ior	ı																																								
A	1	2	3	4	5	6	7	8	9	1 0	1	1	1 3	1	1 5	1 6	1 7	1	1 9	2 0	2	2	23	2	2 5	2 6	27	28	2 9	3 0	3	3 2	3	3 4	3 5	3 6	3 7	3	3 9	4 0	4	4	4 3	4 4	4 5	4 6	4 7
A	1	2	3	4	5	6	7	8	9	1 0	1	1	1	1	1 5	1 6	1 7	1 8	1 9	2 0	2	2	23	24	25	26	27	2 8	2 9	3 0	3	3 2	3	3 4	3 5	3	3 7	300	3 9	4	4	4	43	4 4	4 5	4 6	4 7
П					Х					х			Γ		Х					Х					х					Х					х					х					х		
A	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1 3	1 4	1 5	1 6	1 7	1	1	2 0	2	2	23	2 4	2 5	2 6	2 7	2	2 9	3 0	3 1	3 2	3	3 4	3 5	3 6	3 7	3 8	3 9	4 0	4	4	4 3	4 4	4 5	4 6	4 7
A	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1 3	1	1 5	1 6	1 7	1	1 9	2 0	2	2 2	23	2	2 5	2 6	27	2	2 9	3 0	3 1	3 2	3	3 4	3 5	3 6	3 7	3 8	3 9	4 0	4	4	4	4	4 5	4 6	4 7
в	1	2	3	4	5	6	7	8	9	1 0	1	1 2	13	1 4	1 5	1 6	1 7	1	1 9	2 0	2	2	23	24	2 5	2 6	27	2	2 9	3 0	3	32	3	34	35	3	3 7	3	3 9	4	4	4	43	4	4 5	4 6	4 7
в	1	2	3	4	5	6	7	8	9	1 0	1	1 2	1	1 4	1 5	1 6	1 7	1	1 9	2 0	2	2	23	2 4	2 5	2 6	27	2	2	3	3	32	3	3 4	35	3	3 7	3	3 9	4 0	4	4	4	4	4 5	4 6	4 7
П		х					Х					х					х					х					Х					х					х					Х					х
в	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1 3	1 4	1 5	1 6	1 7	1	1 9	2 0	2	2	23	24	2 5	2 6	2 7	2	2 9	3 0	3 1	3 2	3	3 4	3 5	3 6	3 7	3	3 9	4 0	4	4	43	4	4 5	4 6	4 7
в	1	2	3	4	5	6	7	8	9	1 0	1	1 2	1 3	1 4	1 5	1 6	1 7	1	1 9	2 0	2	2	23	2	2 5	2 6	27	2	2 9	3 0	3	3	3	3 4	3 5	3 6	3 7	3	3 9	4 0	4	4	4	4	4 5	4 6	4 7

3 3 4 4 4 4 4 4 4 4 8 9 0 1 2 3 4 5 6 7

Rep 4: NON-Irrigation

Fig 3. IRRIGATION SYSTEM









Fig 6. Temperature and precipitation pattern at HLARC- experimental site

Fig 7. Effect of irrigation water on yield and starch content of cassava in the 2019 - 2020 crop season



				Plan 3	3: 22	May 2	019								20) Jun 2	020	
				Plan 3	2: 22	May 2	019						20	Apr 2	020			
				Plan :	1: 22	May 2	019				19 F	eb 20	20			-		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
					20	19									2020			

Fig 8. Effect of irrigation water on yield and starch content of cassava in the 2020 - 2021 crop season

Harvest plan	Rainfall	Irrigation
Plan 1	1446 mm	36 mm
Plan 2	1232 mm	51 mm
Plan 3	1230 mm	51 mm



							Plan	3: 22 /	Aug 20	020			21 Ap	r 2021	1			
					Plan	2: 22 .	Jun 20	20				21 M	ar 202	21		-		
			Plan	1: 22 /	Apr 20	20				20 Ja	an 202	21						
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
					20	20									2021			

Fig 9. Visually evaluate harvested cassava plants in the 2019 - 2020 crop season





2019-2020

- The irrigation treatment did not impact fresh root yield and starch content for cassava varieties KU50 and D7.
- The yields were high due to abundant rainfall and a shorter dry season.
- Irrigated cassava showed uniformity in yield, which aids disease detection.





2020-2021

- Irrigation increased yield moderately (4-18%) compared to rainfed treatment.
- Starch concentration remained consistent at 26-29%.
- The unusual rainfall pattern in the region during the trial period resulted in lower irrigation requirements.

III. CONCLUSION & RECOMMENDATION

✓ Irrigation during the dry season can help increase and uniform cassava yields.

- ✓ The plan of planting and harvesting is an important factor that determines the effect of the irrigation.
- ✓ The starch content decreases while the yield increases over time, starting from the earliest harvest.

Consequently, farmers can choose the optimal harvest time to meet market demand and maximize economic benefits.

✓ Besides, irrigation is important for tunnel-grown plantlets. Comparing experiments of cutting-grown crops and tunnel plant-grown crops was conducted during the 2022-23 season

APPENDIX PICTURES



IRRIGATION AND SENSOR SYSTEM SET UP





CASSAVA GROWTH AND DEVELOPMENT





CASSAVA HARVESTING







THANK YOU FOR YOUR ATTENTION!