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AGRONOMIC ACTIVITIES IN NORTH SUMATRA: Intercropping, Organic Fertilizer and Soil Tillage on Cassava Root Rot

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Introduction

EXISTING CONDITION OF CASSAVA IN NORTH SUMATRA

Cassava is planted in North Sumatra mainly for commercial crop. The yield of cassava in North Sumatra is higher compared to the mean national or other province yield, although planted with a traditional technology.

One of the reason farmers planted cassava in a very close distance (90 x 60 cm or 80 x 60 cm) due to weed interference commonly with flat very little grown in mound or ridges. Therefore root rot is often occurs in farmers field.



Household survey results 2017

Farmers planting cassava intercropping with maize 20%

Farmers planting cassava monoculture 80%

Based on this survey farmers interest to grown cassava intercropping with maize, but unfortunately the yield of maize is very low due to higher rain intensity → maize cob was rot.

Therefore intercropping cassava with various crops is required to offer the income of cassava based farming system

Farmers planting cassava with high density and applying fertilizer: 60%

Farmers only planting cassava with high density : 26.7%

Farmers plant cassava with high density, density, applying fertilizer and making ridges : 13.3%

Only small percentage of farmers planting cassava with high density and applying fertilizer. Thus it is needed to show farmers that applying fertilizer will increase the yield of cassava; furthermore with making ridges it will reduce the possibility of water logging at flat land (reducing root rot attack)



Material and Methods

A. INTERCROPPING OF CASSAVA IN NORTH SUMATRA



objectives:

1. to obtain an intercrop system which can increase farmers' income
2. to familiarize farmers with intercropping system in cassava field

Experimental treatment:

(1) cassava monoculture, (2) Cassava intercropped with maize, (3) mungbean, (4) soybean, (5) peanut, (6) upland rice, (7) mellon, (8) red bean, (9) cowpea and (10) ginger. The treatments were arranged in a Randomized Block with 4 replications.



Malang4 variety was used.

- Cassava planting space was 125x70 cm. Fertilizer application of cassava was applied manure (goat manure) at 5 t/ha.
- Basic fertilizer and around 2 months after harvesting of cowpea received 300 kg/ha phonska.
- Fertilizer application for upland rice and maize were 200 kg Ponska as basal fertilizer at 2 weeks then 200 kg Urea/ha applied at 1.5 months.
- For soybean, peanut and cowpea fertilizer were applied 150 kg Ponska and 50 kg Urea/ha at 2 weeks after planting.
- For mellon fertilizer was applied 150 kg Ponska at 2 weeks after planting and 150 kg/ha Ponska at 4 weeks. However due to high of rainfall mellon did not grow well.



B. Goat Manure and Soil Tillage on Cassava Root Rot

Plot size is 7x5 m. In Tanjung Pinggir and Sipayung the spacing is 80x60 cm, and variety used is Malaysia.

Planting date: 4 January 2019.

In Sibisa there are two sites by the spacing is 80x60 cm with variety Malang4 and Ubi Roti from Lampung. Planting date: 20-25 April 2019.

Split plot design in four replications.

The main plots are two goat dunk application in cassava plantation, namely No goat dunk application (Mo) and goat dunk applied by 10t/ha (M1). The subplot are three soil tillage, namely mound (P1), ridges (P2) and flat bed (P3).



Performance of trials

Malang4 free from root rot



Variety of Malan4
Without any
incident of root rot



Trials in Sibisa

Malaysia in
Sipayung infested
by root rot



Table 1. Yield of cassava under fertilizer trials in North Sumatra (ton/ha)

No.	Treatments (N-P ₂ O ₅ -K ₂ O)	Sinaksak Malang 4	Tj Tonga Malang 4	Tj Pinggir Dacon	Tj. Pinggir Huaibong	Sipayung Farsem
1	45 - 45 -45	31.72ab	36.67b	23.17b	19.80c	36.55b
2	90 - 45 -45	31.72ab	36.90b	23.85b	21.15bc	37.35b
3	45 - 45 - 115	47.10a	44.20a	28.20a	26.32a	43.65a
4	60 - 60 - 60	30.37b	37.80b	24.75ab	22.72ab	38.35b
5	10 t Manure	30.37b	36.00b	24.75ab	23.62b	36.67b
	LSD 5%	4.08	2.67	3.84	2.78	1.95
	CV %	8.53	4.53	10.00	7.95	3.29



Results and Discussions

Table 2 Yield of associated crop in cassava intercropping (ton/ha), Siantar 2019.

Treatments	I	II	III	IV	Total	Average
1.Cassava monoculture	-	-	-	-	-	-
2.Maize	3.90	4.15	3.64	3.26	14.95	3.74
3.Mungbean	1.12	0.98	1.05	1.10	4.25	1.06
4.Soybean	1.54	1.61	1.72	1.63	6.50	1.62
5.Peanut	3.13	3.05	2.96	2.99	12.13	3.03
6. Upland rice	3.56	3.54	3.05	3.25	13.20	3.30
7.Melon	-	-	-	-	-	-
8.Red bean	1.53	1.63	1.85	1.68	6.71	1.68
9.Cowpea	2.00	1.92	1.83	1.75	7.50	1.87
10 Ginger	4.29	5.18	5.09	5.21	4.94	4.94



Table 3. Cassava yield t/ha uder intercropping, Siantar 2019

Treatments	I	II	III	IV	Total	Average
1.Cassava monoculture	42.56	39.27	40.31	38.97	161.11	40.27
2.Maize	23.10	21.25	22.68	21.95	88.98	22.25
3.Mungbean	38.93	39.12	37.24	37.44	152.73	38.18
4.Soybean	37.62	36.95	37.38	38.10	150.05	37.51
5.Peanut	35.10	34.28	34.73	35.24	139.35	34.83
6. Upland rice	32.26	31.85	30.94	31.67	126.72	31.68
7.Mellon	41.27	40.94	39.95	38.78	160.94	40.23
8.Red bean	38.94	39.13	38.22	37.20	159.49	38.37
9.Cowpea	38.21	36.18	35.74	36.56	156.69	36.67
10 Ginger	30.26	31.33	31.25	30.70	123.54	30.88



Table 4. Yield of cassava Malang4 intercropping and gross income with various crops, Siantar 2019

Treatments	Cassava yield (t/ha)	Yield of intercropped (t/ha)	Gross income Rp/ha
1 Cassava monoculture	40.27	-	40.270.000
2 Maize	22.25	3.74	35.714.000
3.Mungbean	38.18	1.06	51.430.000
4.Soybean	37.51	1.62	49.697.500
5.Peanut	34.83	3.03	53.010.000
6. Upland rice	31.68	3.30	48.180.000
7.Mellon	40.23	Grow but no fruit at all	40.230.000
8.Red bean	38.37	1.68	56.850.000
9.Cowpea	36.67	1.87	47.920.000
10 Ginger	30.88	4.94	62.990.000



Table 5. Yield of cassava Malaysia (t/ha) from ridge trial in Tanjung Pinggir Siantar January 2020.

Treatment		I	II	III	IV	Total	Average
Without Manure	Mound	48.51	39.94	47.29	46.74	182.48	45.62
	Ridge	52.15	47.37	49.56	50.08	199.16	49.79
	Flat	38.24	41.02	36.19	34.26	149.71	37.42
Manure 10t/ha	Mound	60.56	59.27	57.74	59.98	237.55	59.38
	Ridge	58.15	61.62	62.38	63.12	245.27	61.32
	Flat	39.63	42.34	43.84	44.08	169.89	42.47



Table 6. Yield of cassava Malaysia (t/ha) from Fertilizer trial in Sipayung Siantar February 2020

Treatments		I	II	III	IV	Total	Average
Without Manure	Mound	47.30	36.17	43.42	45.73	172.62	43.15
	Ridge	54.22	48.39	50.65	51.19	204.45	51.11
	Flat	42.03	38.25	36.28	35.34	151.90	37.97
Manure 10t/ha	Mound	61.65	62.28	59.94	61.93	245.80	61.45
	Ridge	62.57	63.05	61.73	60.86	248.21	62.05
	Flat	40.43	40.08	39.81	38.85	159.17	39.79



Table 7. Yield of cassava Malaysia (t/ha) from Root-rot control trial in Siantar January - February 2020.

Manure	Treatment	Cassava yield (t/ha) at ...	
	Bed type	Tanjung Pinggir	Sipayung
Without manure	Mound	45.62	43.15
	Ridge	49.79	51.11
	Flat	37.42	37.97
	Mound	59.38	61.45
	Ridge	61.32	62.05
	Flat	42.47	39.79



Table 8. Yield of cassava Malang4 (t/ha) from Fertilizer trial in Sibisa Tobasa 31 May 2020

Treatments		I	II	III	IV	Total	Average
Without Manure	Mound	42.25	46.16	38.24	41.28	167.93	41.98
	Ridge	51.37	47.72	49.56	48.90	197.55	49.38
	Flat	40.10	36.53	35.82	37.60	150.05	37.51
Manure 10t/ha	Mound	60.56	59.82	57.46	60.83	238.67	59.66
	Ridge	61.97	62.85	60.93	59.95	245.70	61.42
	Flat	39.43	40.94	38.98	37.67	157.02	39.25



Table 10. Yield of cassava Ubi Roti (t/ha) from Fertilizer trial in Sibisa Tobasa 1 June 2020

Treatments		I	II	III	IV	Total	Average
Without Manure	Mound	38.75	45.69	39.84	41.87	166.15	41.53
	Ridge	50.72	50.25	47.64	49.05	197.66	49.41
	Flat	36.17	39.36	34.28	38.05	147,86	36.96
Manure 10t/ha	Mound	50.40	51.98	53.62	56.37	212.37	53.09
	Ridge	48.78	53.59	57.96	55.54	215.87	53.96
	Flat	37.57	39.95	36.80	38.73	153.05	38.26



Table 11. Yield of cassava Malang4 and Ubi Roti (t/ha) from Root-rot control trial in Sibisa Tobasa May-June 2020.

Treatment		Cassava yield (t/ha) for variety of...	
Manure	Bed type	Malang4	Ubi Roti
Without manure	Mound	41.98	41.53
	Ridge	49.38	49.41
	Flat	37.51	36.96
10t/ha	Mound	59.66	53.09
	Ridge	61.42	53.96
	Flat	39.25	38.26

Both with and without manure, the flat land that did not have any mound or ridge treatment showed the lowest yield, possibly due to the root rot attack



Discussion



A. Intercropping of cassava with various crops indicated that upland rice is very good, in North Sumatra very responsive to grow rice as associate crop with cassava

Ginger is the most profitable to generate income for cassava farming system. Hence, due to the cassava price fluctuation, farmers seems to be interested in planting ginger as the sub-crop in the cassava intercropping system.



Discussion

B. Root rot in cassava is seriously occurred in many areas including in North Sumatra. Cassava root is rotten mainly in field with cassava all year, without change to other crops. Therefore in this research the root rot occurred (around 1.8%) in flat areas (Malaysia variety in Sipayung), and consequently when the high rainfall, then water logging is occurred. While in mound and ridge did not show infested any symptom of root rot.



Conclusion

- A. Intercropping of cassava with maize is common practice by 20% of farmers participated in the study. However due to huge of rain the yield of maize was not good only around 0.7-1.0 t/ha. Alternatively intercropping of cassava could be done by ginger due to better price compare to maize.
- B. From the root rot research indicated that among four sites only one site in Sipayung revealed incident of rotten of cassava root in variety of Malaysia, especially in flat imethod. While in Tanjung Pinggir also used Malaysia did not occur. So do in Sibisa with variety of Malang4 and Ubi Roti were not infested by cassava root rot.





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