Cassava current Agronomy Practices : East Nusa Tenggara - Indonesia

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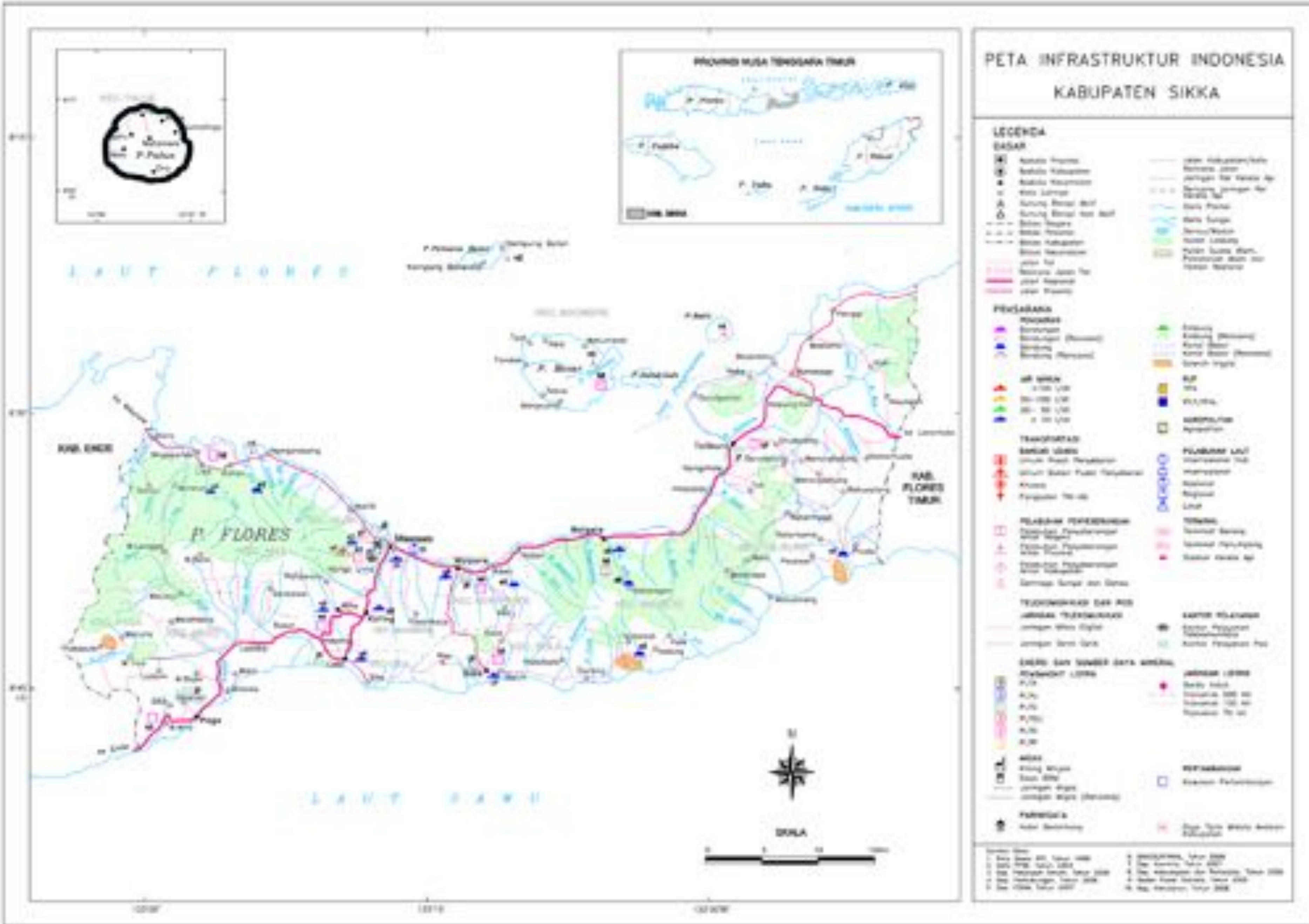
Cassava planting Area in Sikka Regency, East Nusa Tenggara

- The Sikka regency is consists of 21 district (Kecamatan)
- Main agricultural commodities are :
  - Cacao
  - Clove
  - Copra
- Agronomy commodities mainly are :
  - Rice (paddy rice field and upland rice field)
  - Corn
  - Cassava


PETA INFRASTRUKTUR INDONESIA
KABUPATEN SIKKA
LEGENDA
DASAR
PROVINSI NUSA TENGGARA TIMUR
L A U T   F L O R E S
L A U T   S A W U
P. FLORES
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KAB. FLORES TIMUR
P. Palue
SKALA

Cassava Usage in Sikka Regency

- Cassava varieties planted in Sikka regency mainly are local varieties → variety for consumption (low starch content 3 varieties), and the other for tapioca starch production (1 variety).
- Farmers are used to plant cassava with no fertilizer or manure application, as intercropping plant with corn. Cassava planting space usually 4 m x 2 m (in the intercropping system) → low yield of cassava

Cassava in East Nusa Tenggara

- Planting period : October to January
- Harvesting period : August to November
- Farmers sold the fresh cassava to the local market
- Fresh cassava tubers (sweet cassava) price per 20 kg Rp 150.000 (in the local market → for consumption)
- Bitter cassava price (for starch production) → Rp 1.100 per kg, with the condition buyer handle the harvesting and transportation.
- There are small tapioca starch industries in Sikka Regency → (Mr. Toni)

Cassava Usage in Sikka Regency

- Cassava are mainly use as staple food (in dry season), substitute corn.
- In a small amount cassava chips also being used for snacks

Problems:

- Cassava yield: 5 – 10 t/ha
- Cassava varieties planted in Sikka regency mainly are local varieties → variety for consumption (low yield low starch,
- Farmers are used to plant cassava as intercropping plant with maize. Cassava planting space usually 4 m x 2 m (the reason: afraid to reduce maize yield and making space for the second crop (usualy mungbean) after maize
- Farmers do not use fertilizer or manure.
- Farmers afraid to increase the yield because there is no market

Project activities

- Cassava varieties trial (2016, 2017, 2018)
- Improvement of cropping system (2018)
- Fertilizer Trial (2018)
- Farmers' adoption (2017, 2018, 2019)

Cassava Varieties Experiment

- Aim:

1 To select the high yield cassava variety suit to East Nusa Tenggara Condition

2 To study the response of farmers to new cassava varieties

2016 trial

Cassava Varieties Tested

1. Sika Putih, Local variety, sweet
2. Sika Kuning, Local variety, sweet
3. Mentega, Introduction variety, sweet
4. Tambah Udang, Introduction, sweet
5. Faroka, Introduction variety, bitter
6. UB ½, Introduction variety, bitter
7. UB 14772, Introduction variety, bitter
8. Gajah, Introduction variety, relatively bitter

Results

- Due a very dry season, the cassava cannot grow well (less than 30% for each plot). However, the measurement from individual crops (means of 6 to 9 plants/plots), the growth and yield obtained by the tested variety were:

Cassava varieties	Number of branches per plant	Plant height (cm)	Number of tuber per plant	Tuber yield ($kg.plant^{-1}$)
Sika Putih (Local)	2.04 ± 1.03	157.86 ± 11.53	4.86 ± 1.14	2.80 ± 0.52
Sika Kuning (Local)	2.20 ± 0.77	169.70 ± 7.72	4.75 ± 1.03	2.74 ± 0.66
Mentega	2.00 ± 1.20	164.75 ± 14.02	9.85 ± 2.67	5.06 ± 0.46
Tambak Udang	2.00 ± 0.77	152.76 ± 6.83	11.0 ± 2.19	5.57 ± 0.57
Faroka	2.28 ± 0.48	143.42 ± 2.63	9.75 ± 1.28	5.12 ± 0.84
UB ½	2.77 ± 0.92	143.31 ± 14.66	7.72 ± 1.80	4.22 ± 0.45
UB 1472	1.95 ± 0.88	157.55 ± 22.26	7.15 ± 1.08	4.31 ± 0.49
Gajah	2.00 ± 0.95	180.28 ± 5.03	10.08 ± 2.82	6.85 + 1.20

Variety trials, 3 months

Variety trials, 10 months

Tambak udang

UB 1/2

Gajah

2017 Variety Trials

1. Varieties trial

- Sika Putih, Local variety, sweet
- Sika Kuning, Local variety, sweet
- Tambak Udang, Introduction, sweet
- Faroka, Introduction variety, bitter
- UB ½, Introduction variety, bitter
- UB 14772, Introduction variety, bitter
- Gajah, Introduction variety, relatively bitter
- Malang 6, Introduction variety, bitter
- Aldira , Introduction variety, bitter

2017 Variety Trial

2. Varieties tested by farmers

- Tambak Udang, Introduction, sweet
- Faroka, Introduction variety, bitter
- UB ½, Introduction variety, bitter
- UB 4772, Introduction, bitter
- Malang 6, Introduction variety, bitter
- Aldira , Introduction variety, bitter

Variety trial 3.5 months

Variety trial 3.5 months
(farmers' field)

Variety trial 9 months
(attacked by mealybugs)

Results

- Due a very dry season, the cassava could not grow well (about 30% for each plot). However, the measurement from individual crops (means of 6 to 9 plants/plots), the growth and yield obtained by the tested variety were:

	Cassava varieties	Experimental Field		Farmers Field	
		Mealy Bugs (%)	Yield (ton.ha^{-1})	Mealy Bugs (%)	Yield (ton.ha^{-1})
-	Sika Putih	20	25.7	-	-
H	Sika Kuning	25	26.6	-	-
A	Adira 1	41	31.2	100	29.4
B	Tambak Udang	65	32.5	100	28.2
C	Faroka	50	36.8	100	34.7
D	UB 1/2	52	34.8	100	34.2
E	UB 4472	39	33.6	100	35.7
F	Gajah	35	45.7	-	-
G	Malang 6	54	38.5	100	35.2

2017 ACTIVITIES, Variety trial: Field day

- Objective: To understand the response of farmers to introduced cassava varieties.
- Characteristics to evaluate: Yield, crop performance (tuber form, branches characteristics), taste
- Results (Farmers preference): Gajah, Tambak Udang, UB ½, Malang 6, Faroka

Farmers Field Day

- Farmers were invited to the experimental site, and directly introduced to the variety tested.
- Farmers were asked to prioritized which of the cassava traits is important to them.
  - Scaling: important; somewhat important; not important
- Farmers were given list to identified which variety they like and don't like, based on each traits.
  - Scoring: 1 (like); (0) either; (-1) dislike

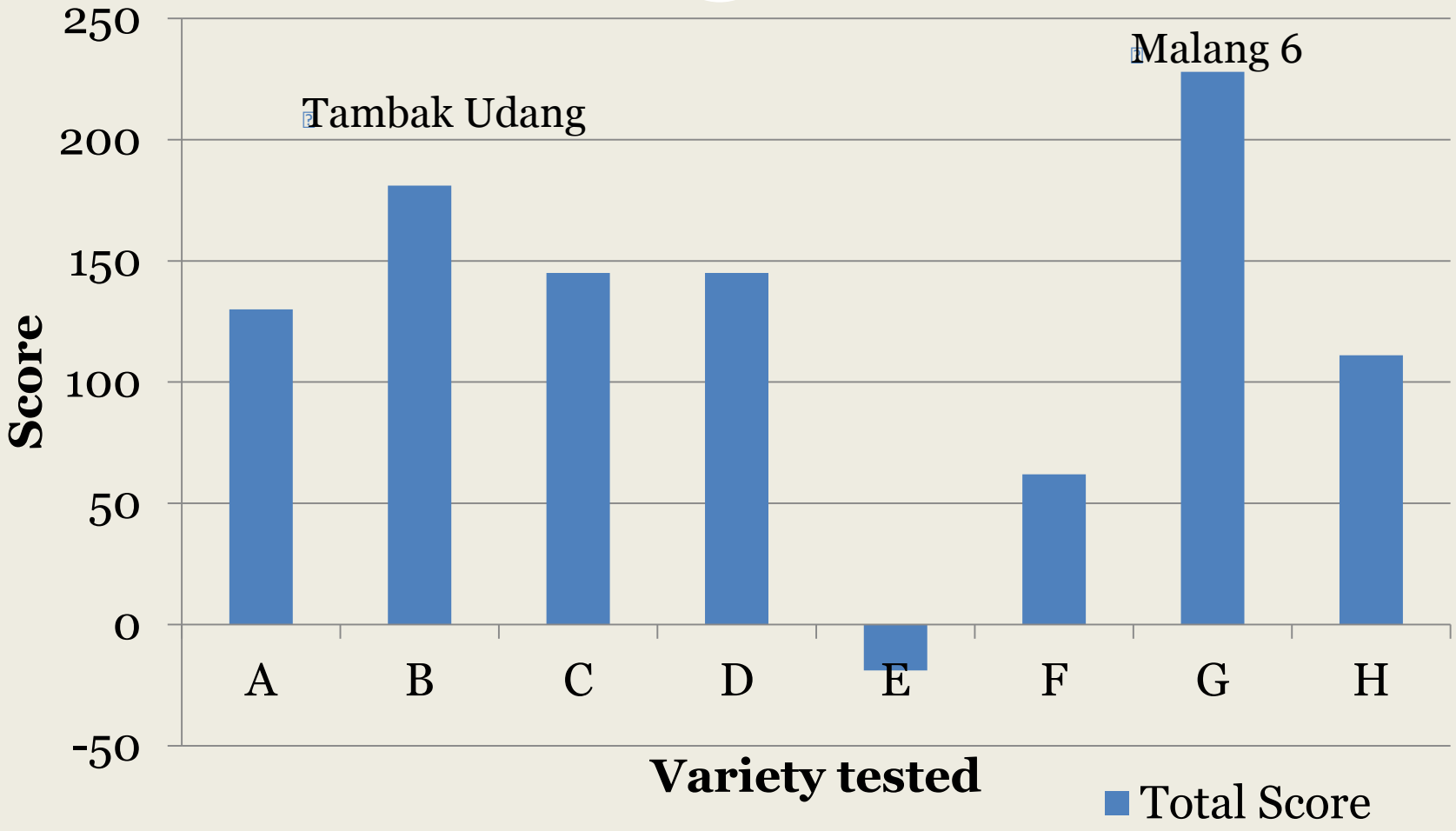
Farmers Preference

Characteristics	Not important	Somewhat important	Important	Total
Branches	5	12	17	34
Height	3	19	12	34
Tuber Direction	1	10	23	34
Tuber Shape	7	17	10	34
Number of Tuber	2	4	28	34
Tuber Colour	10	16	8	34
Taste	2	4	28	34
Yield	0	13	21	34

Farmers Preference

Characteristic	Variety Tested							
	A	B	C	D	E	F	G	H
Branches	18	24	16	20	-17	3	26	6
Height	32	28	19	24	5	17	30	-3
Tuber Direction	24	26	25	20	3	22	32	28
Tuber Shape	14	6	14	12	-5	14	32	23
Number of Tuber	24	28	30	24	5	12	18	21
Tuber Colour	24	32	24	26	7	12	34	21
Taste	-23	16	-3	-10	-22	-20	30	-6
Yield	17	21	20	29	5	2	26	21
Total Score	130	181	145	145	-19	62	228	111

Farmers Preference



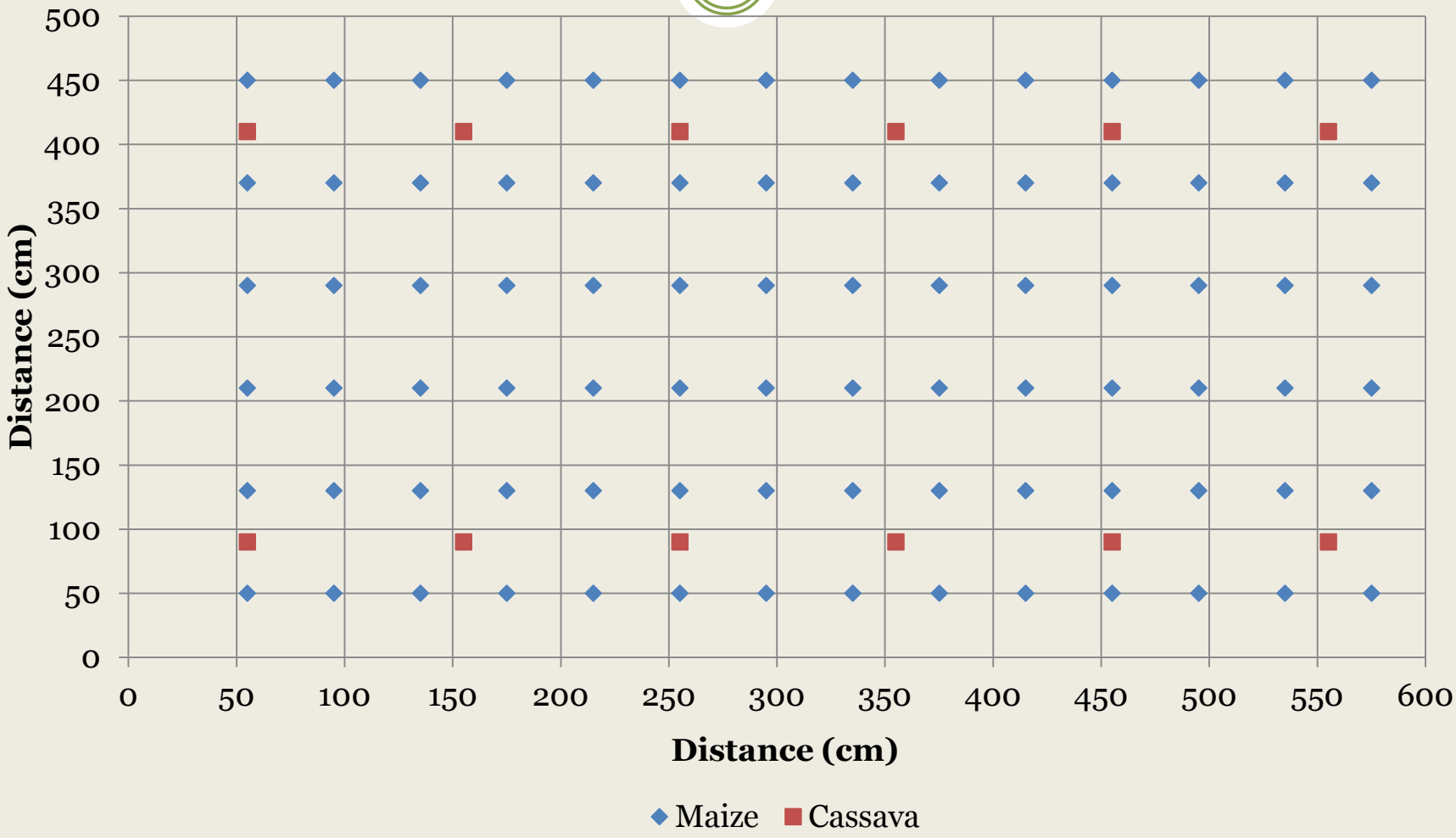
Intercropping Trial

Experiment Design	**Cassava Based Intercropping**
Replication : 4	
Experiment Trial Field Size = 5 m x 6 m	
Treatment	**Treatment Code**
Control (Cassava Monoculture)	CO
Intercropping Cassava + Maize Local System	TS 1
Intercropping Cassava + Maize Local Introduction System	TS 2
Intercropping Cassava + Peanut	TS 3
Intercropping Cassava + Mung bean	TS 4
Fertilization : Urea (300 kg.ha^{-1} three time time application, @100 kg.ha^{-1}), SP 36 (100 kg.ha^{-1} one time time application), and KCl (100 kg.ha^{-1} one time application)	

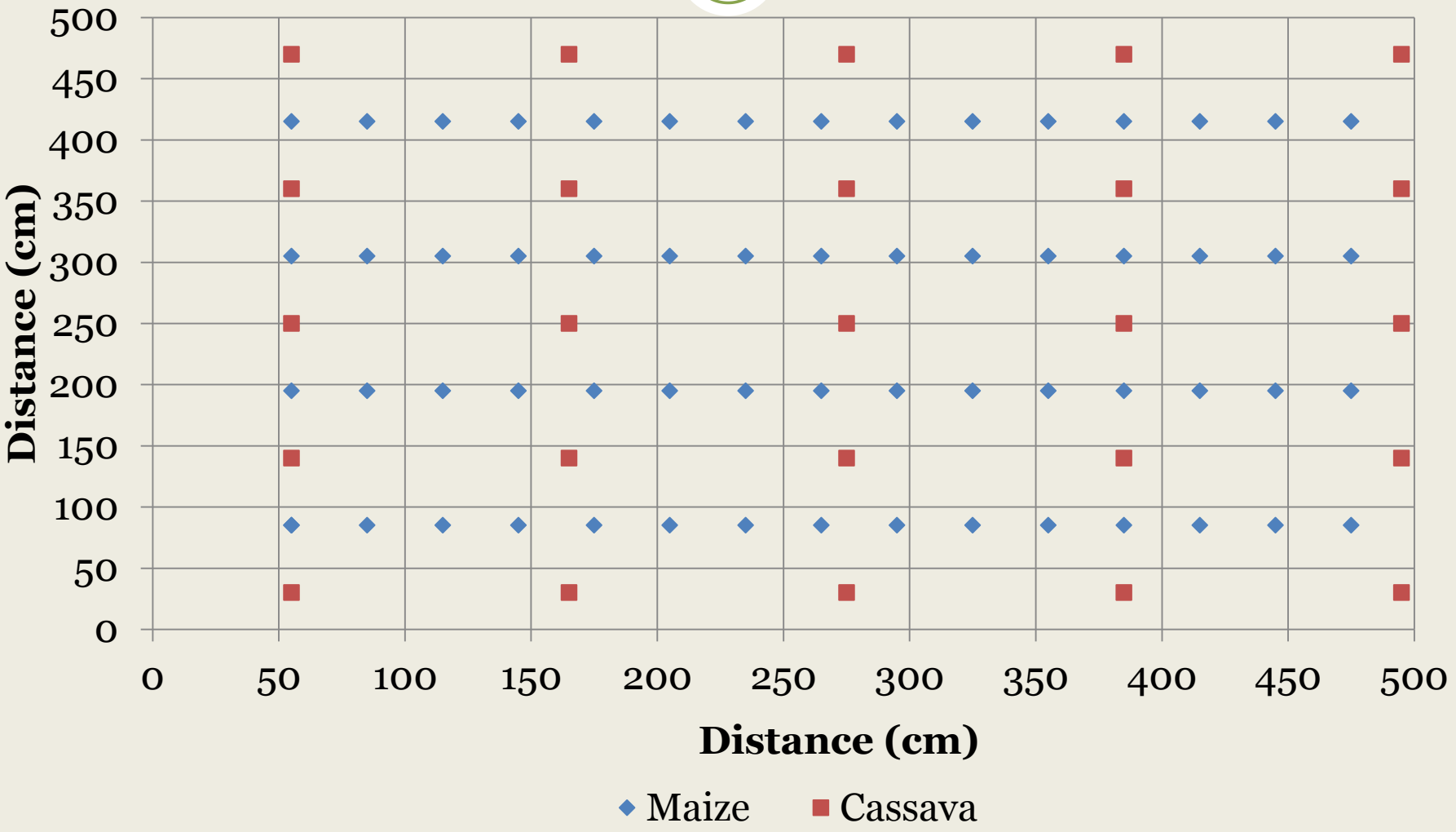
Cassava + Maize
Local System

Cassava + Maize
Introduction System

Cassava + Maize Intercropping Local System



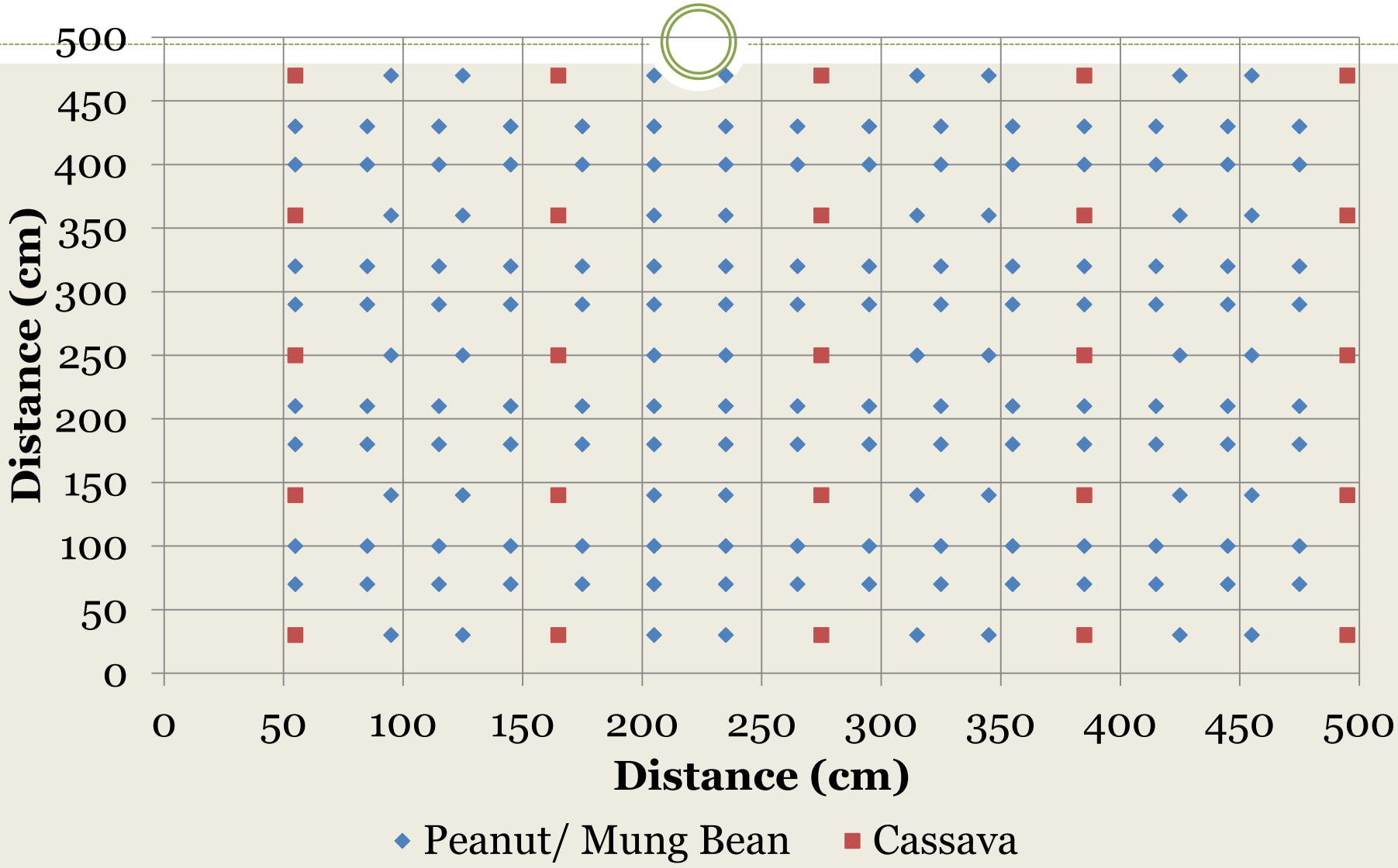
Cassava + Maize Introduction System



Cassava + Peanut

Cassava + Mung Bean

Cassava + Peanut/Mung Bean Intercropping



Results and Discussion

Maize Characteristic

Planting system	Plant height (cm)	Cob length (cm)	Cob weight (kg/cob)	Grain number/cob	Grain weight/cob (g)	Grain yield (t/ha)
Maize monocultutre	182.43	19.34	0.31	310.23	99.46	3.94
Maize + cassava local system	190.23	20.04	0.32	315.15	102.34	4.05
Maize + cassava intro system	185.36	19.58	0.30	316.50	109.24	4.32

The results showed that the introduction system had the similar yield of maize with the local system (4.32 and 4.05 $t.ha^{-1}$, respectively)

Results and Discussion

Cassava Characteristic

Treatment	Plant height (cm)	Tuber number/ plant	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg/plant)
Cassava monoculture	333.37	14.00	50.37	3.42	3.43
Cassava + maize (local system)	337.75	14.80	47.35	3.16	3.32
Cassava + maize (Intro system)	323.00	13.20	42.75	3.00	2.43
Cassava + peanut	331.87	12.80	46.50	3.16	2.67
Cassava + mungbean	330.00	12.80	46.25	3.44	2.56

- There was no significant difference in the cassava growth between different intercropping system.
- The tuber weight of the cassava local system was higher than the introduction system → due to larger planting space the root tends to be larger

Results and Discussion

Cassava Yield

Treatment	Fresh aerial biomass (t/ha)	Tuber yield (t/ha)	Total biomass (t/ha)	Harvest Index
Cassava monoculture	32.78	33.19	65.97	0.50
Cassava + mize (local system)	13.17	10.04	23.21	0.43
Cassava + maize (Intro system)	20.45	24.78	45.23	0.55
Cassava + peanut	36.78	27.08	63.86	0.42
Cassava + mungbean	35.55	26.28	61.83	0.43

Cassava + Maize introduction system had harvest index higher than 0.5, thus indicated that tuber development was relatively higher than vegatative growth.

Results and Discussion

Land Equivalent Ratio

$$\frac{\text{Yield1 (Intercrop)}}{\text{Yield1 (monoculture)}} + \frac{\text{Yield2 (Intercrop)}}{\text{Yield2 (monoculture)}}$$

Land Equivalent Ratio higher than 1 indicates that the cropping system had better land use efficiency

Results and Discussion

Land Equivalent Ratio

Treatment	Yield t/ha cassava	Yield t/ha intercrop	monoculture	LER Cassava	LER Intercrop	Total LER
Cassava monoculture	33.19	0.00	33.19	1.00	0	1.00
Cassava + maize (local system)	10.04	4.05	4.17	0.30	0.97	1.27
Cassava + maize (Intro system)	24.78	4.32	4.17	0.75	1.04	1.78
Cassava + peanut	27.08	1.26	2.00	0.82	0.63	1.45
Cassava + mungbean	26.28	0.63	1.45	0.79	0.43	1.23

The introduction intercropping system showed higher LER than the local system, thus the introduction system had better landuse effeciency

Results and Discussion

Farmers Gross Income

Treatment	Yield t/ha		Gross income		Total Gross Income
	cassava	intercrop	cassava	intercrop	
Cassava monoculture	33.19	0.00	18,254,500	0	18,254,500
Cassava + maize (local system)	10.04	4.05	5,522,000	12,152,875	17,674,875
Cassava + maize (Intro system)	24.78	4.32	13,629,000	12,972,250	26,601,250
Cassava + peanut	27.08	1.26	14,894,000	12,600,000	27,494,000
Cassava + mungbean	26.28	0.63	14,454,000	9,450,000	23,904,000

The results showed that the local system had the lowest gross income compare to other intercropping system. The cassava + peanut intercropping system showed the highest farmer gross income.

Cropping system: Field day

- During the farmers field day, there were few farmers that interested to try the cropping system.
- Farmers in person had realized that by planting cassava in closer planting space did not reduce maize yield

Engagement in Value Chain

- Increase farmers' income by panting new high yield cassava varieties and improve cropping system and management (fertilization, weeding).
- To enhance the adoption of new technologies, the project conducted training in cassava production and processing
- To ensure the farmers do a correct technology, the project involving the agricultural extensionist from the local Agricultural Office
- To broaden the markets by involving the trader and processor in the project.

Farmers Training

Adoption of the Project Technologies

- During 3 field days there were 46 farmers want to participate the introduce technologies (cropping system and new cassava varieties. However, because of limitation project facilities, the project can only accommodated 26 farmers.

Cropping System Adaptation (Planting Season 2017 – 2018)

- There are four villages that starting to adapt the cropping system (maize + cassava intercropping) for the 2017 – 2018 planting season.
- From 26 farmers, 21 of them planting new cassava varieties, and 5 practice improve-cropping system. Each farmers planted 0.2 – 0.3 ha varieties on their land (Gajah, Malang 6, Faroka, and Tambak Udang varieties).
- Project help with planting materials, fertilizer and a small amount of cash money for land preparation and weeding.

Village	Number of Farmer Participate
Bloro (high-land)	4 Farmers @ 0.5 ha
Tebuk (high-land)	8 Farmers @ 0.25 ha
Wolohuler (high-land)	8 Farmers @ 0.25 ha
Langir (low-land)	6 Farmers @ 0.25 ha

Plot Location Map

Thank You