Modification of Cassava Intercropping System in East Nusa Tenggara - Indonesia

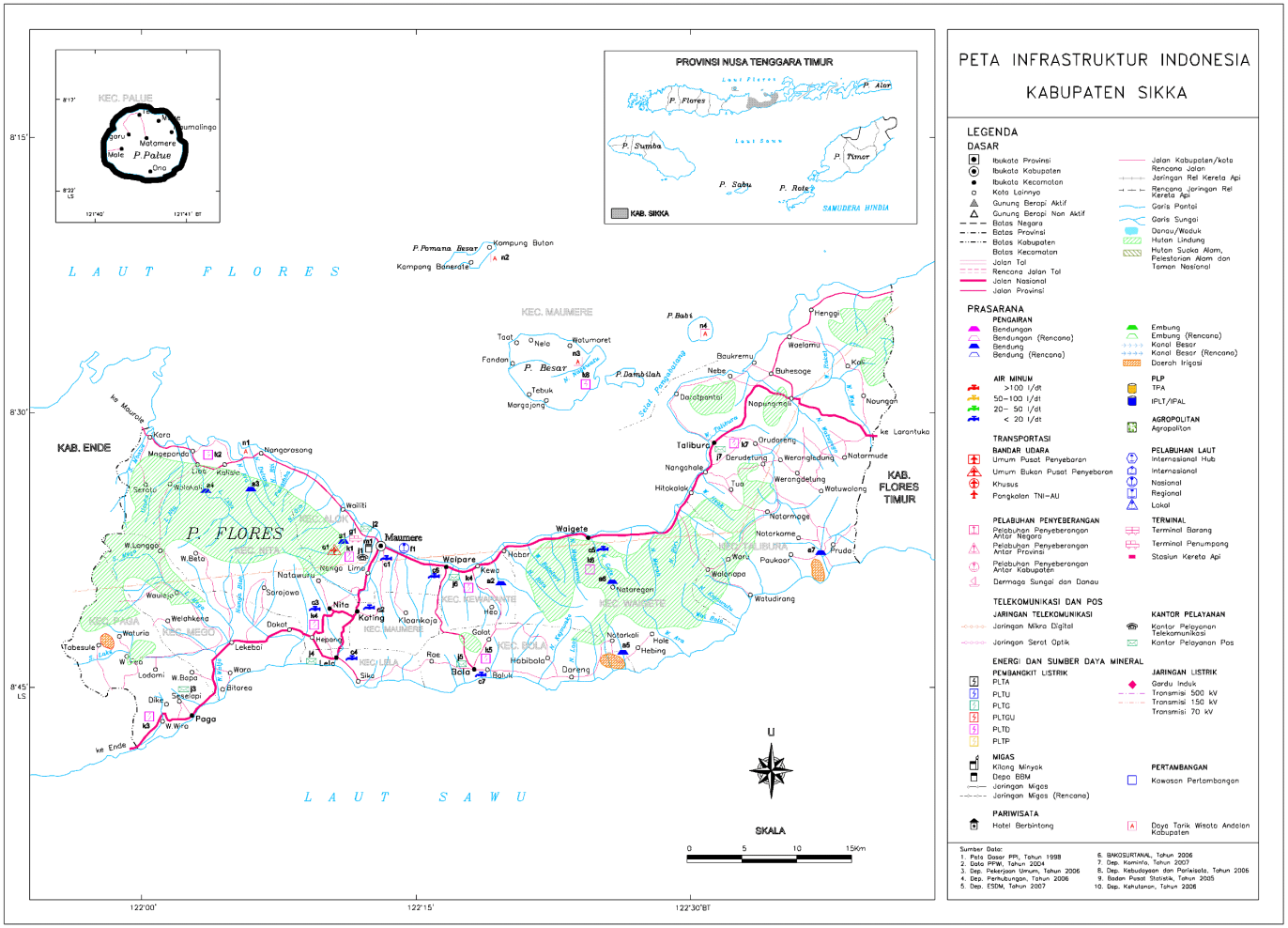
CIAT SOUTHEAST ASIA

RESEARCH CENTRE FOR TUBER CROPS
THE UNIVERSITY OF BRAWIJAYA

FACULTY OF AGRICULTURE UNIVERSITY OF
NUSA NIPA

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



Cassava Usage in Sikka Regency

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

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)

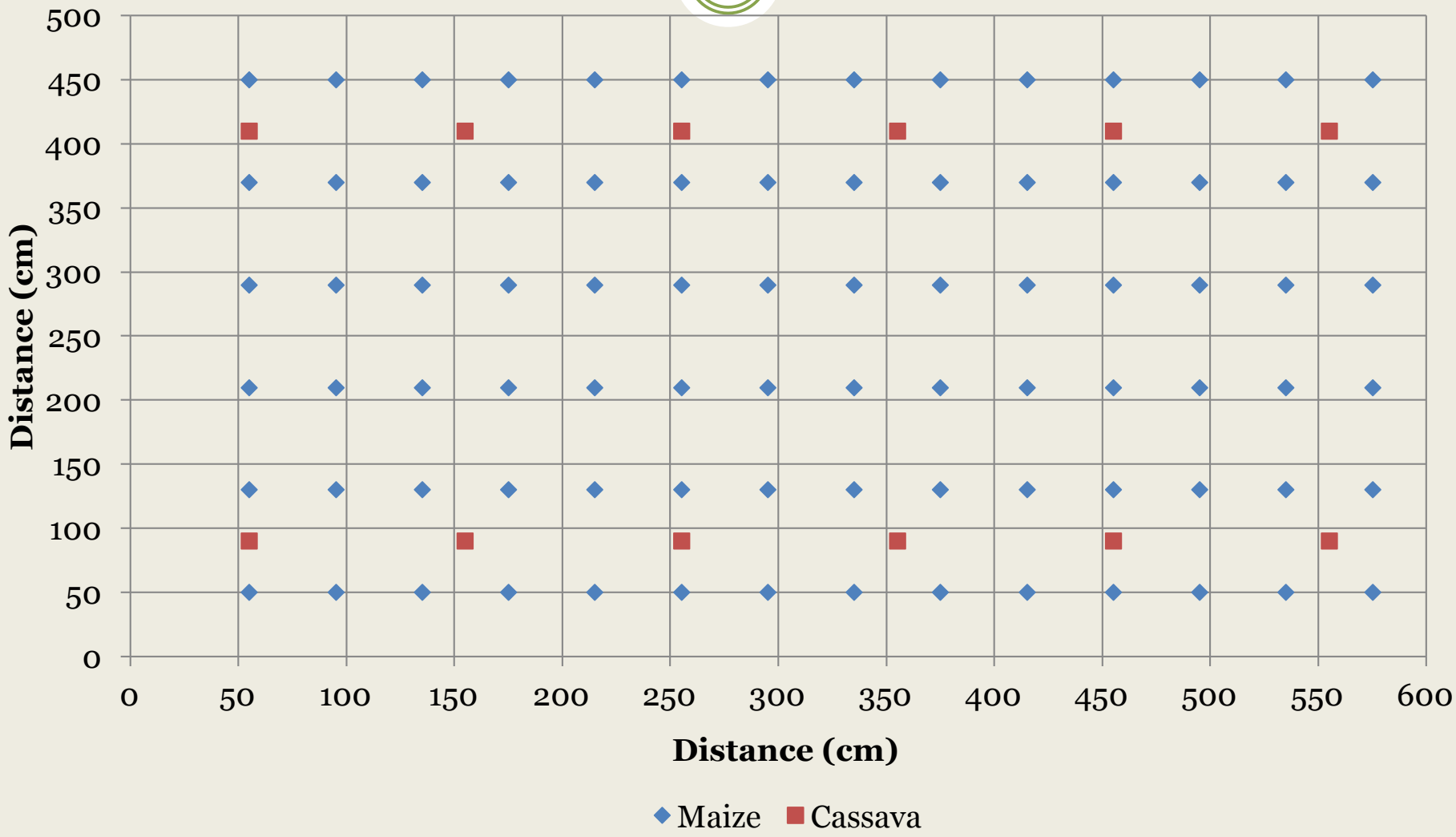
Intercropping Trial

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)	

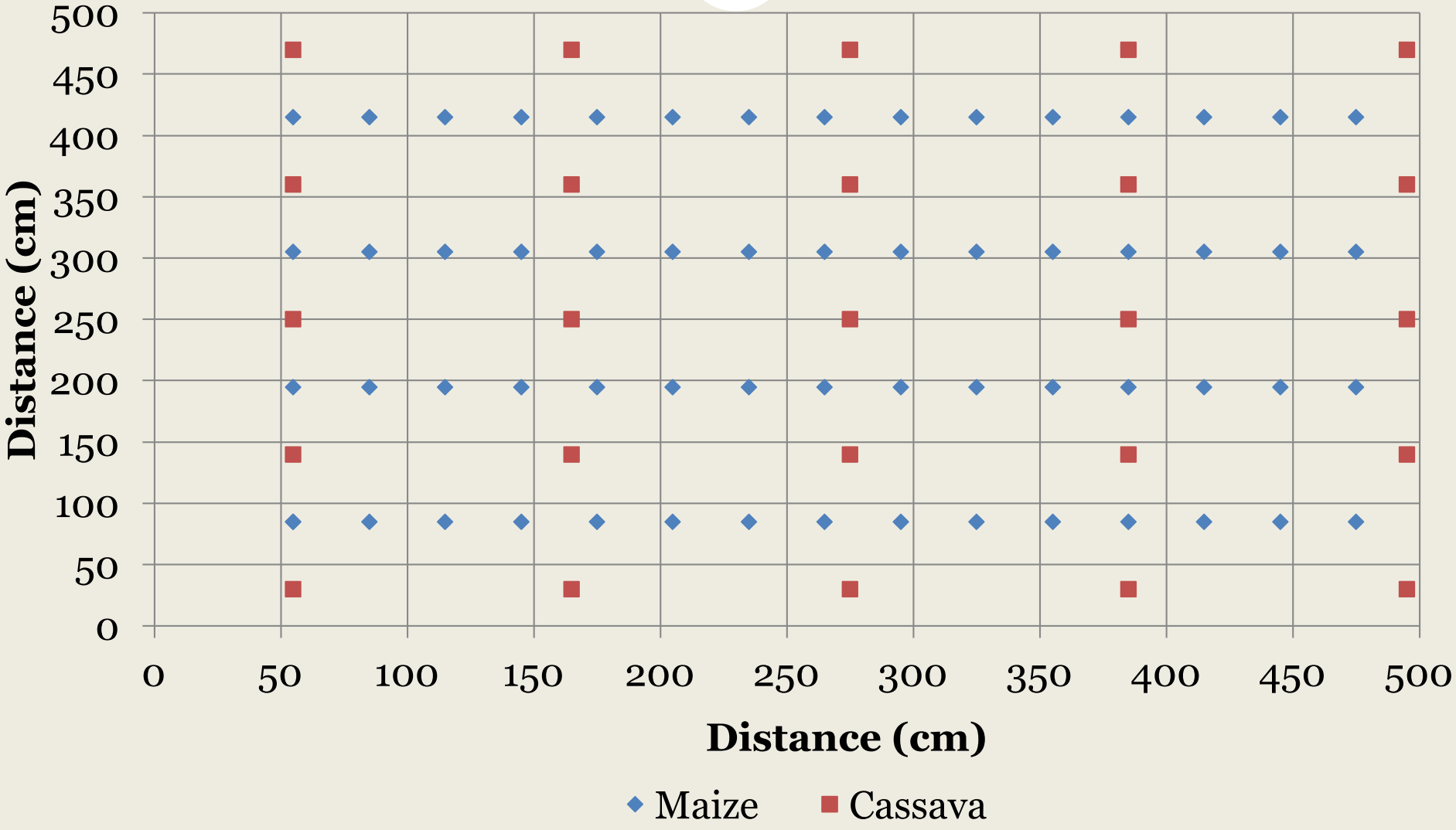
Cassava + Maize
Local System

Cassava + Maize
Introduction System

Cassava + Maize Intercropping Local System



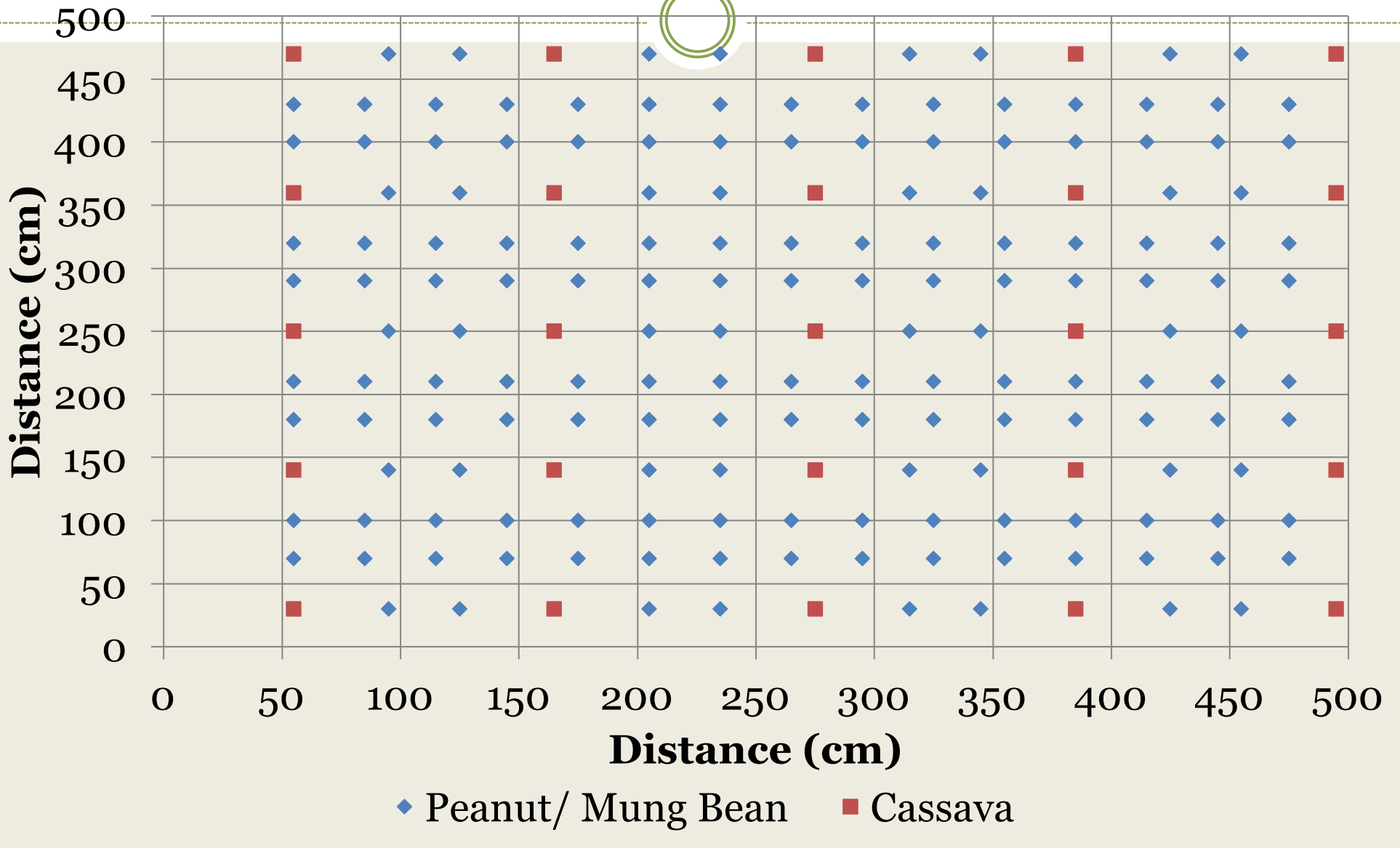
Cassava + Maize Introduction System



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.

- 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

Conclusion

- Opportunities for expanding area for cassava plantation
- Needs improvement on soil fertilization and water management
- New cassava varieties introduction, specifically for dry-land area (tolerant to dry condition)
- Introducing intercropping system with closer planting space did not reduce maize yield as farmers fear before.