

*3rd Annual Meeting of the Asian Cassava Breeders Network, Kasetsart University,
Thailand, December 3-6 2017*

Cassava Breeding Update : UNIVERSITY OF LAMPUNG

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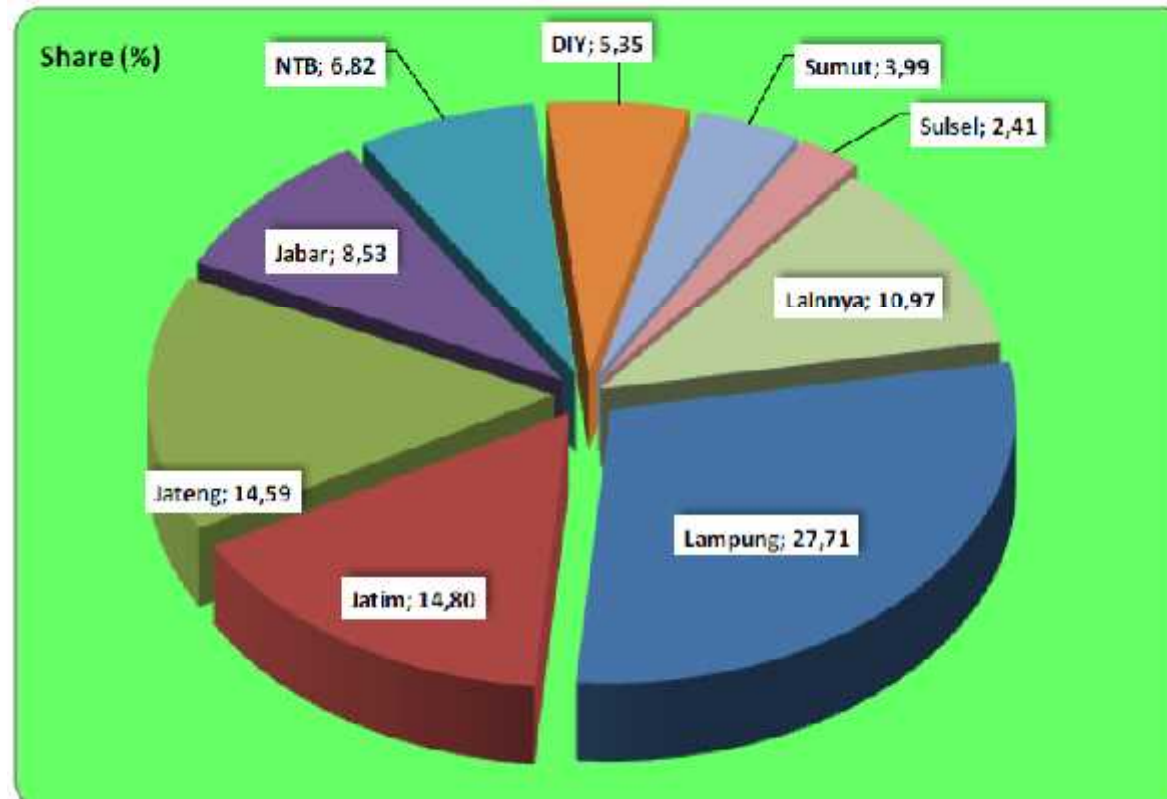
*** Director of Research and Community Service Institute*



Why Cassava?



- During 2012-2016, Lampung Province with harvested area average 295,55 thousands hectares is dominant that contributes 27,71% of national harvested area

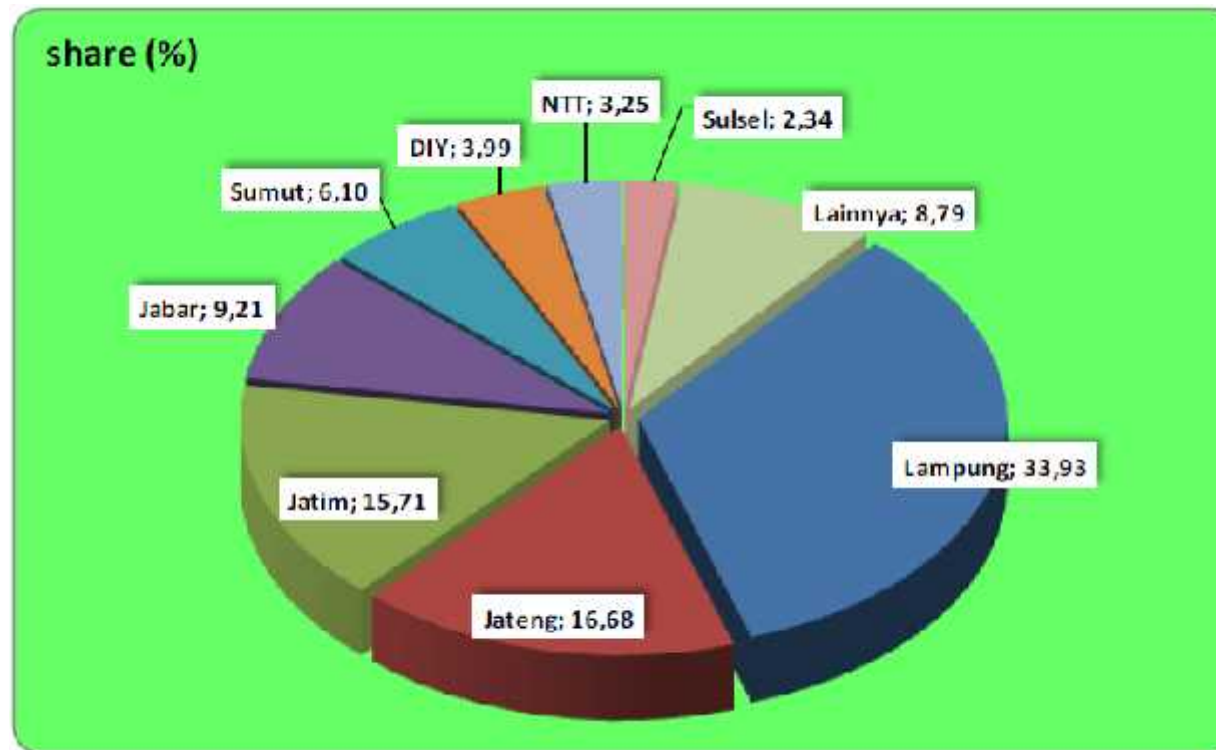


Source: Outlook Komoditas Pertanian Tanaman Pangan:
Ubikayu, 2016

Why Cassava?



- Cassava production in Lampung Province was about 33,93% percent of national cassava production during 2012-2016 with production average about 7,74 million tons per year



Source: Outlook Komoditas Pertanian Tanaman Pangan: Ubikayu, 2016

Why Research & Development?



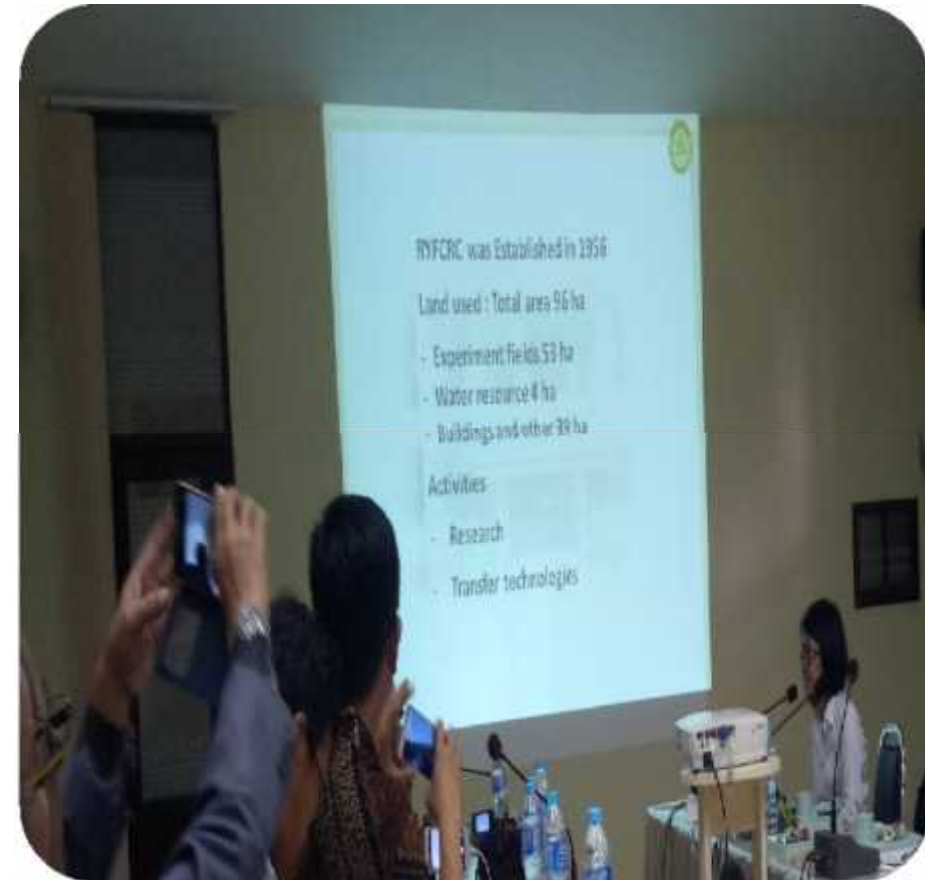
Prof. Charensuk Rojanaridpiched
Breeder of Cassava Kasetart Variety



Through R & D, **Prof. Charensuk**
invented well-known Kasetart Variety
(KU 50)

Why Research & Development?

Rayong Field Crops Research Center, Thailand





Laboratorium Terpadu Unila

MOU of UNILA and Kasetsart University



MOU of UNILA and King Mongkut's University of Technology Thonburi

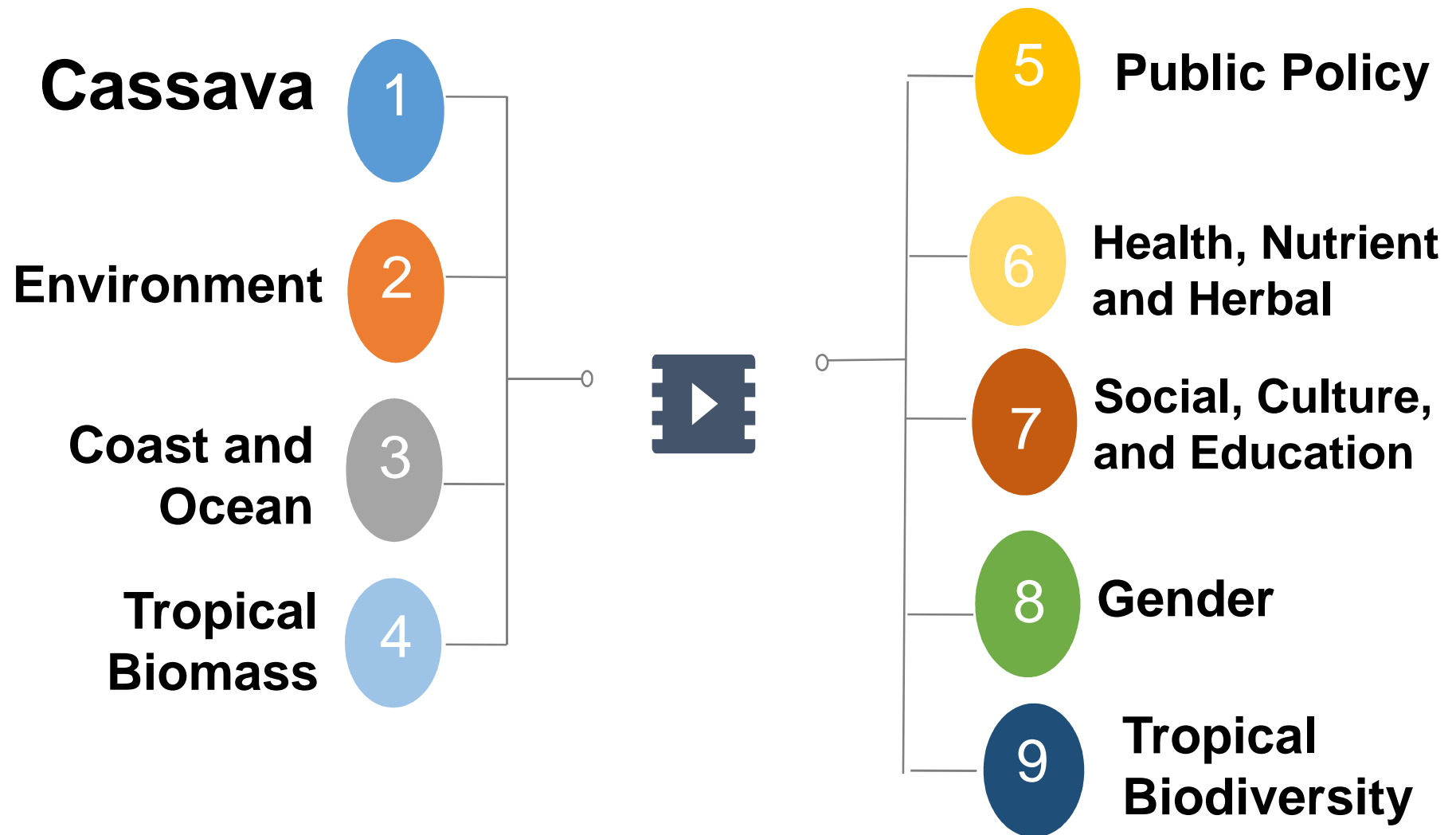


MOU of UNILA and Thai Tapioca Development Institute

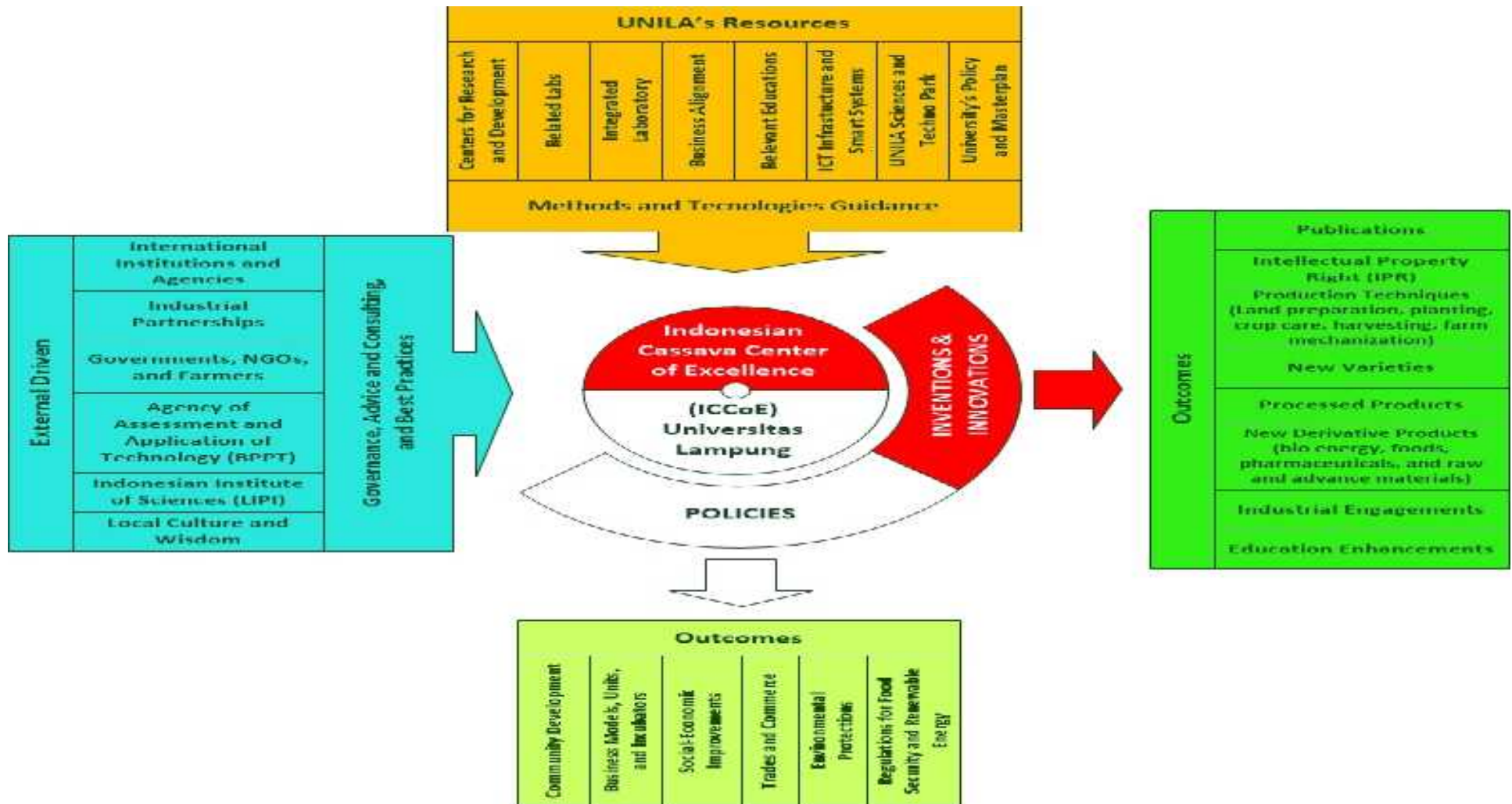


Tapioca Development Institute, October

RESEARCH AND DEVELOPMENT CENTER



Fostering Excellence on Cassava



International Conference on Cassava

CIRCULAR
2

International Conference on Cassava (Sustainable Management of Renewable Resources in Tropics)

Call For Papers

Academic scientists, Researchers, Policy Makers, Businessmen, Practitioners and NGOs are invited to submit original, unpublished paper in .docx format via Open Conference System (OCS) through website of International Conference on Cassava :<http://smarrt-ul.unila.ac.id/>. Full paper format can be downloaded from <http://smarrt-ul.unila.ac.id/>

Topics and Keynote Speakers

1. Prof. Dr. Ir. Sudaryono: Balai Penelitian Tanaman Aneka Kacang dan Umbi: **"Cassava Productivity in Indonesia"**
2. Thai Tapioca Development Institute, Thailand: **"Integrated Management of Cassava Mealybug in Thailand"**
3. Dr. Piya Kittipadukul: Kasetsart University: **"Cassava Breeding Program for High Yield"**
4. Prof. Kaneko Nobuhiro: Yokohama National University : **"Soil Conservation for Sustainable Cassava Productions"**
5. Dirjen Penguatan Inovasi, Kemenristekdikti: **"Innovation and Development of Cassava for Community Welfare"**

Important Dates

Abstract submission due	: 5 November 2017
Acceptance notification	: 7 November 2017
Paper submission due	: 15 November 2017
Registration fee payment	: 7 – 20 November 2017
Conference days	: 23 – 24 November 2017

Topics

1. Production and Utilization Systems
2. Technology Development Aspects
3. Socio Economic and Regulation Aspects
4. Ecological and Environmental Perspectives

Student



Participant
IDR 400.000
Presenter
IDR 500.000

General

Participant
IDR 500.000
Presenter
IDR 600.000

Payment can be transferred via bank :



Bank : BNI
Branch : Tanjung Karang
Account Name : Erwin Yuliadi
Account Number : 0596832097

Selected manuscripts are recommended to be published in journals:

1. Agrivita (International journal indexed scopus)
2. Tanah Tropika (Nationally Accredited)
3. Hama dan Penyakit Tumbuhan Tropika (Nationally Accredited)
4. Teknologi Industri Pertanian IPB (Nationally Accredited)

Field Trip to Pahawang

25 November 2017

Pahawang is a beautiful island located in the sub-district of Punduh Pidada, district of Pesawaran, Lampung.



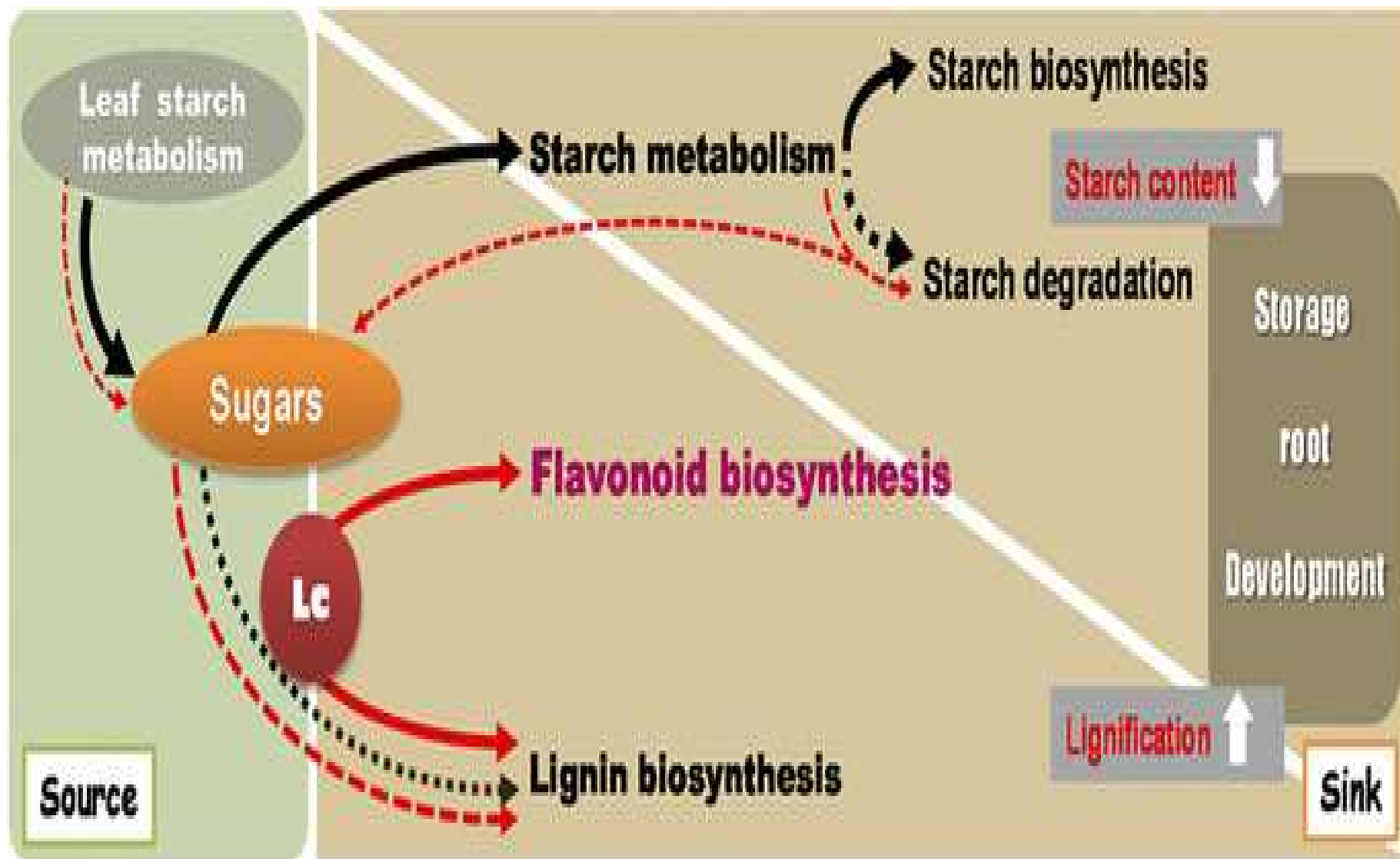
Vanue
Emersia Hotel & Resort
Jl. WR. Monginsidi No.70, Pengajaran, Tik. Betung Utara,
Kotz Bandar Lampung, Lampung 35214
Indonesia
(0721) 258258



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<http://smarrt-ul.unila.ac.id/>
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Organized by







Without



Pupuk Mikro Dosis Anjuran



Pupuk Mikro Double Dosis Anjuran



Pupuk Mikro Menjelang Panen

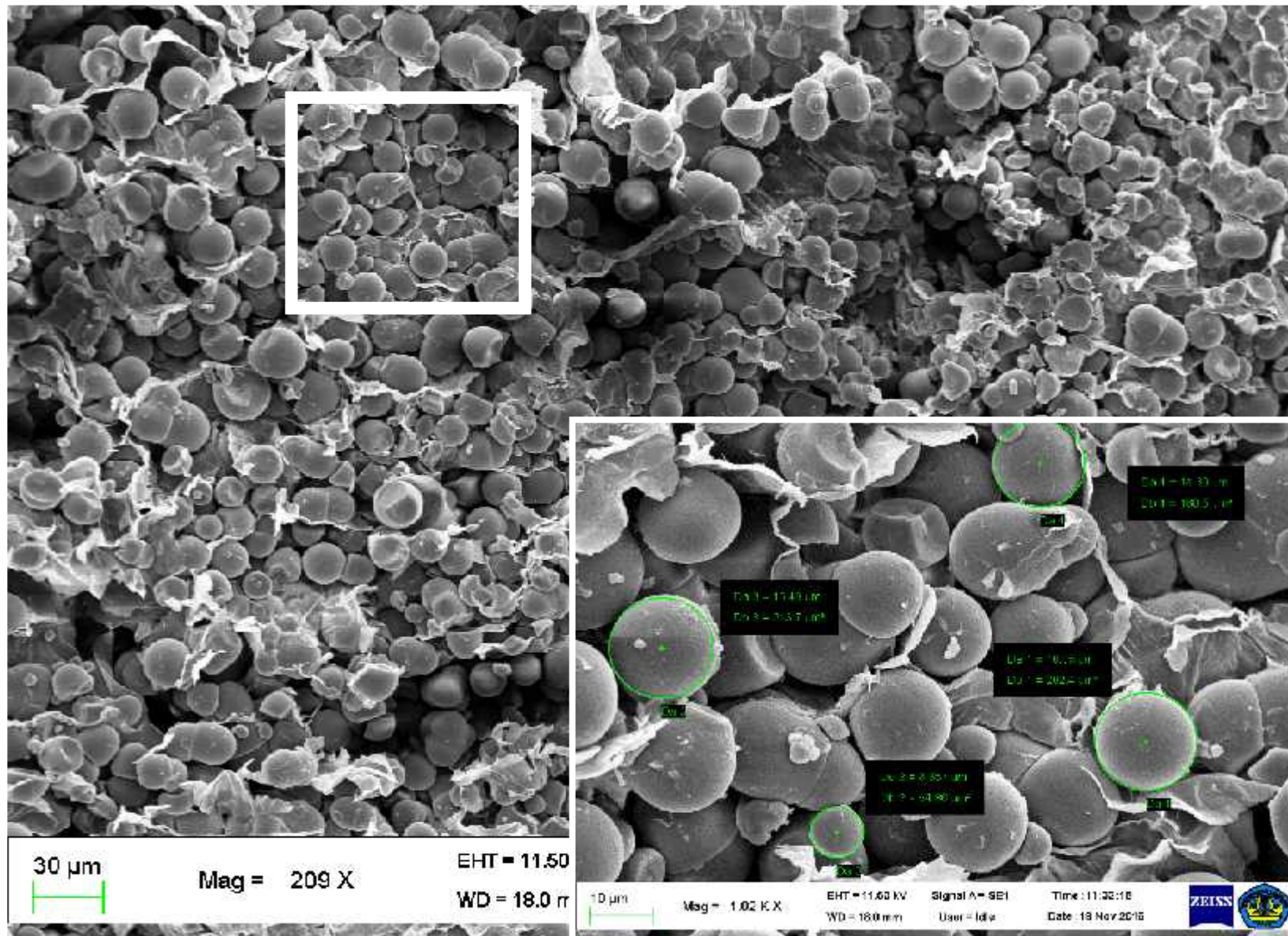


Fig. Size of starch granule applied by 0 kg micro nutrient/ha (range 8.3 – 16.5 µm)

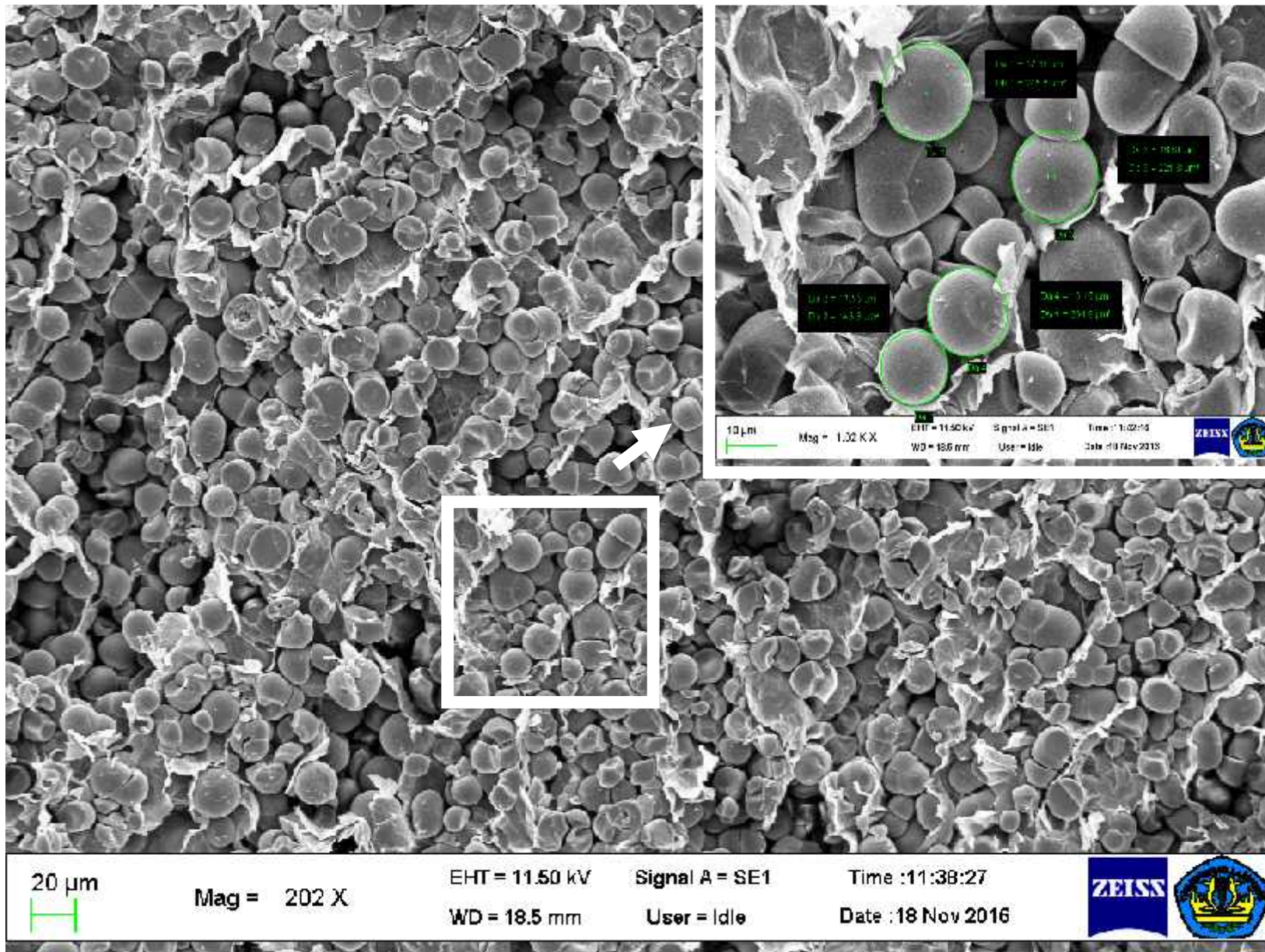


Fig. Size of starch granule applied by 20 kg micro nutrient/ha (range 13.5 – 17.7 µm)

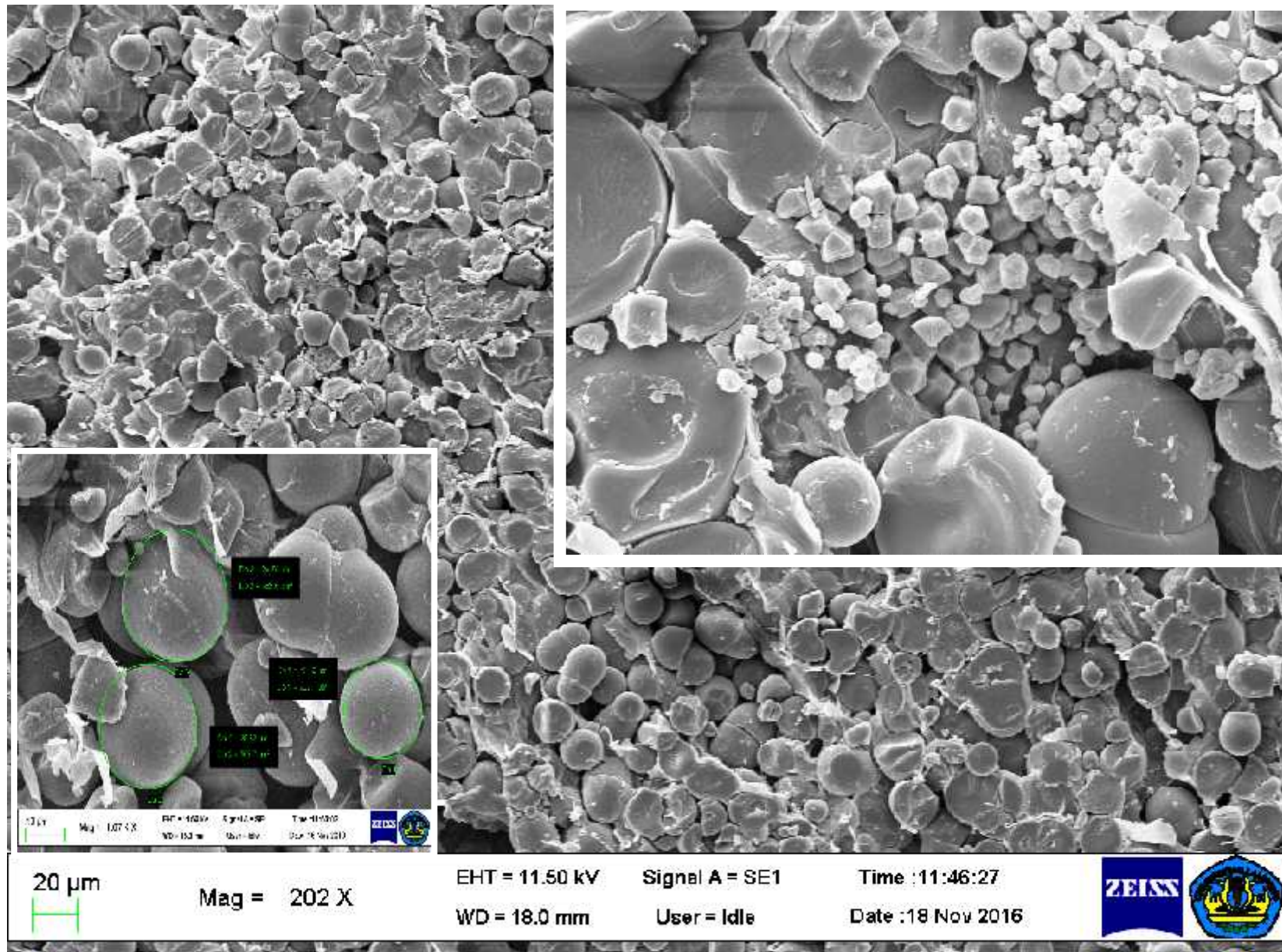


Fig. Size of starch granule applied by 40 kg micro nutrient/ha (range 20.3 – 26.87 μm)

2010	2011	2012	2013	2014	2015	2016	2017	2018
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Germplasms, superior cassava clones

Preliminary and advanced yield trials (2015 -2018)

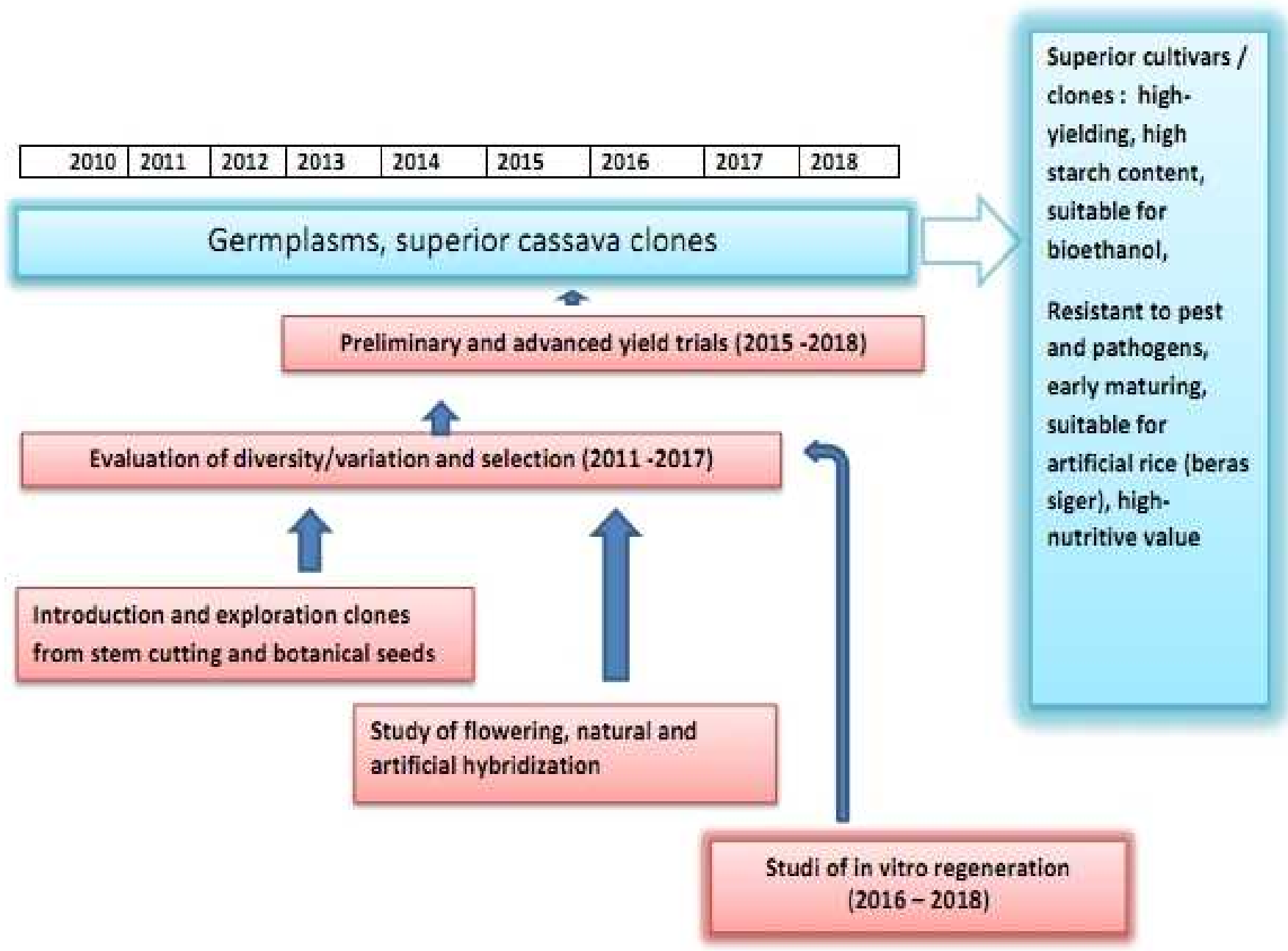
Evaluation of diversity/variation and selection (2011 -2017)

Introduction and exploration clones from stem cutting and botanical seeds

Study of flowering, natural and artificial hybridization

Studi of in vitro regeneration (2016 - 2018)

Superior cultivars / clones : high-yielding, high starch content, suitable for bioethanol, Resistant to pest and pathogens, early maturing, suitable for artificial rice (beras siger), high-nutritive value



Time (month)	Stage (old system)	Stage (new system)	Time (month)
0	Crossing of selected parental genotypes	Crossing of selected parental genotypes	0
6	F1 (3000-5000) (6 months) 1 plant/1 site/1 rep	F1 (3000-5000) (10 months) 1 plant/1 site/1 rep	10
18	F1C1 (2000-4000) (1 year) 1 plant/2 sites/1 rep	Clonal evaluation (1000-1500) (1 year) 6-8 plants/1 site/1 rep	22
30	Clonal evaluation (500-1000) (1 year) 6 plants/1 site/1 rep	Preliminary yield trial (150-300) 10 plants/1 site/3 rep	34
42	Preliminary yield trial (100-200) (1 year) 20 plants/1-2 sites/1 rep	Advanced yield trial (40-80) (2 years) 25 plants/2-3 sites/3 reps	58
66	Advanced yield trial (30-60) (2 years) 25 plants/2-3 sites/3 reps		

ELITE GERMPLASM



(Ceballos et al., 2007))

CASSAVA BREEDING UNIVERSITY OF LAMPUNG

- 2000 - 2010 : Agronomic evaluation, yield trial, tissue culture for micro-cutting
- 2011 : collection, exploration of local clones, F1 clones from botanical seed (half-sib population)
- 2012 - present: More intensive development of half-sib population from 80 parental clones in highland Sekincau, West Lampung
- 2013 – present: clonal evaluation, preliminary and more advanced yield trial.
- 2015 : New Rector : Center of research and development of Cassava
- 2016 – 2017 : clonal evaluation and unreplicated yield trial of 700s F1 halfsib population derived from 80s female parents
- 2010 : microcutting through tissue culture
- 2016 : study of genotypes of cassava to micronutrients - starch quality



Cassava hybridization at Highland Sekincau



Cassava yield trials



CASSAVA GERMPLASM REPOSITORY / ACCESSIONS

- Released cultivars, especially from ILETRI
- Local and introduced clones from Central Java, Lampung (30s clones)
- F1 half-sib clones derived from female parents (standard cultivar UJ 3) (20 clones)
- 700s F1 half-sib clones derived from 80 female parents (including standard cultivars: clonal evaluation (unreplicated yield trial in 2017)
- 3000 botanical seeds of F1 population derived from 120s female parents harvested in 2017 (being germinated).
- Replicated yield trials (30s selected clones)
- Second year yield trials (8 clones)

- **Experiments were conducted in Unila Research Station, Natar, South Lampung; each experiment consisted of two replications.**
- **Experiment I evaluated 21 clones; compared to standard cultivar UJ 3.**
- **Experiment II evaluated 23 clones; compared to standard cultivar UJ 3 and UJ 5.**
- **The planting distance was 100 x 50 cm.**

Preliminary yield trials of cassava clones

No	Clones	Parental clones	Description
1	(62) 96-1-101 Cabang	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 96-1
2	Bogor	Tanjung Bintang, Lampung Selatan	F1 half siblings Bogor
3	Bendo3	Sragen, Jawa Tengah	F1 half siblings Bendo
4	Duwet 3	Sragen, Jawa Tengah	F1 half siblings Duwet
5	96-1-110	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 96-1
6	Adira 4	Malang, Jawa Timur	Varietas Unggul Nasional
7	Bayam Liwa 2	Liwa, Lampung Barat	F1 half siblings bayam liwa
8	BL 4	Liwa, Lampung Barat	F1 half siblings BL
9	CMM 25-27-27/10/14-2	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 25-27
10	CMM 96-1-3	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 96-1
11	CMM 96-1-102	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 96-1
12	CMM 96-1-105	Balitkabi, Malang, Jawa Timur	F1 half siblings CMM 96-1
13	Duwet 1	Sragen, Jawa Tengah	F1 half siblings Duwet

Preliminary yield trials of cassava clones

14	Malang 4	Malang, Jawa Timur	National cultivar
15	MU 111	Balitkabi, Malang, Jawa Timur	F1 half siblings Mentik Urang
16	MU 103	Balitkabi, Malang, Jawa Timur	F1 half siblings Mentik Urang
17	MU 104	Balitkabi, Malang, Jawa Timur	F1 half siblings Mentik Urang
18	SL 30	Liwa, Lampung Barat	F1 half siblings Sayur Liwa
19	SL 35	Liwa, Lampung Barat	F1 half siblings Sayur Liwa
20	SL 106	Liwa, Lampung Barat	F1 half siblings Sayur Liwa
21	SL 121	Liwa, Lampung Barat	F1 half siblings Sayur Liwa
22	SL 100116	Liwa, Lampung Barat	F1 half siblings a Sayur Liwa
23	UJ 3	Terbanggi, Lampung Tengah	National cultivar

Selected best five clones based on the root number and root weight per plant

No	Clones	Fresh root weight per plant (g)	Clones	Fresh Root number per plant
1	Malang 4	6442	MU 111	14
2	Bayam Liwa 4	4458	Bayam Liwa 4	13
3	MU 111	4217	Bendo 3	12
4	Duwet 1	3317	Duwet 1	11
5	CMM 96-1-3	3225	Malang 4	11

The selected best five clones based on harvest index and starch rendement

No	Clones	Starch rendement (%)	Clones	Harvest index (%)
1	SL 35	35,7	CMM 96-1-110	72,1
2	Duwet 3	29,6	Bayam Liwa 4	66,7
3	MU 111	26,9	Malang 4	62,9
4	CMM 96-1-105	26,6	SL 103	61,1
5	Duwet 1	26,3	UJ 3	57,4

Promising clones based on the root number per plant, root weight per plant, harvest index, starch rendement, Reproductive branches, and color of root pulp (parenchyma) (part 1)

No	Clones	Root number per plant	Root weight per plant (g)	Starch rendement (%)	Harvest index (%)	Productive branching	Color of root pulp (parenchyma)
1	MU 111	14 ⁽¹⁾	4217 ⁽³⁾	26,9 ⁽³⁾	53,9	0	White
2	Bayam Liwa 4	13 ⁽²⁾	4458 ⁽²⁾	23,2	66,7 ⁽²⁾	0	Yellow
3	Bendo 3	12 ⁽³⁾	3050	25,8	48,0	2	Yellow
4	Duwet 1	11 ⁽⁴⁾	3317 ⁽⁴⁾	26,3 ⁽⁵⁾	50,3	0	White
5	Malang 4	11 ⁽⁵⁾	6442 ⁽¹⁾	23,8	62,9 ⁽³⁾	0	White
6	CMM 96-1-3	2	3225 ⁽⁵⁾	21,6	49,1	1	White

Promising clones based on the root number per plant, root weight per plant (g), harvest index (%), starch rendement (%), productive branching and color of root pulp (parenchyma) (part 2)

No	Clones	Root number per plant	Root weight per plant (g)	Starch rendement (%)	Harvest index (%)	Productive branching	Color of root pulp (parenchyma)
7	SL 35	5	1108	35,7 ⁽¹⁾	45,7	0	White
8	Duwet 3	10,5	2842	29,6 ⁽²⁾	51,7	0	Yellow
9	CMM 96-1-105	5,5	2408	26,6 ⁽⁴⁾	46,1	1	White
10	CMM 96-1-110	8	2842	22,6	72,1 ⁽¹⁾	0	White
11	SL 103	7	3160	24,9	61,1 ⁽⁴⁾	0	White
12	UJ 3	8,5	2092	23,1	57,3 ⁽⁵⁾	0	White

**Five clones based on the root number and
root weight per plant**

No	Clones	Root Number per Plant	Clones	Root Weight per Plant (g)
1	T 190414 Bercabang	14,8	CMM 96-1-105	3741,7
2	Gayor	10,0	MU 111	3425,0
3	Malang 6-101	10,2	UJ 3 110116 MB-2	3391,7
4	MU 22	9,7	T 190414 Bercabang	3075,0
5	BL1	9,8	Malang 6-101	3025,0
	UJ 3	6,0	UJ 3	1208,3
	UJ 5	9,2	UJ 5	2341,7

Five promising clones based harves index and starch rendement

No	Clones	Harves Index (%)	Clones	Starch rendement (%)
1	UJ 3 Kecil	67,48	MU 111	28,83
2	CMM 25-27 MB 1	66,53	SL 221	27,64
3	SL 87	66,11	SL 36	27,13
4	CMM 25-27-281014	63,47	CMM 25-27-3	26,08
5	T 190414 Bercabang	62,87	CMM 25-27-172	25,74
	UJ 3	47,17	UJ 3	11,71
	UJ 5	57,93	UJ 5	15,20

16 promising clones based on the root number per plant, root weight per plant, harvest index, starch rendement (%), reproductive branches, and color of root pulp(parenchyma) part 1)

No	Clones	Root number per plant	Root weight per plant (g)	Harvest index (%)	Starch rendement (%)	Level number of reproductive branches	Color of root pulp (parenchyma)
1	T 190414 Bercabang	14,8 ⁽¹⁾	3075,0 ⁽⁴⁾	62,87 ⁽⁵⁾	21,69	1	Cream
2	Gayor	10,0 ⁽²⁾	2800,0	62,54	20,35	0	White
3	Malang 6-101	10,2 ⁽³⁾	3025,0 ⁽⁵⁾	51,08	21,16	0	Cream
4	MU 22	9,7 ⁽⁴⁾	2600,0	46,56	19,23	0	White
5	BL 1	9,8 ⁽⁵⁾	2758,3	53,98	15,16	3	Cream
6	CMM 96-1-105	7,8	3741,7 ⁽¹⁾	59,06	21,92	0	Cream
7	MU 111	6,9	3425,0 ⁽²⁾	54,83	28,83 ⁽¹⁾	0	Cream
8	UJ 3 110116 MB-2	10,2	3391,7 ⁽³⁾	61,96	23,74	0	White

No	Clones	Root number per plant	Root weight per plant (g)	Harvest index (%)	Starch rendement (%)	Level number of reroductive branches	Color of root pulp (parenchyma)
9	UJ 3-Kecil	8,5	2008,3	67,48 ⁽¹⁾	23,37	0	Cream
10	CMM 25-27 MB1	7,8	2900,0	66,53 ⁽²⁾	21,78	1	White
11	SL 87	7,7	2466,7	66,11 ⁽³⁾	22,67	0	White
12	CMM 25-27-281014	8,0	2816,7	63,47 ⁽⁴⁾	25,43	0	Cream
13	SL 221	8,0	2541,7	51,76	27,64 ⁽²⁾	0	White
14	SL 36	9,2	1866,7	54,32	27,13 ⁽³⁾	0	White
15	CMM 25-27-3	8,7	2700,0	61,79	26,08 ⁽⁴⁾	1	Cream
16	CMM 25-27-172	6,3	2666,7	57,07	25,74 ⁽⁵⁾	0	White

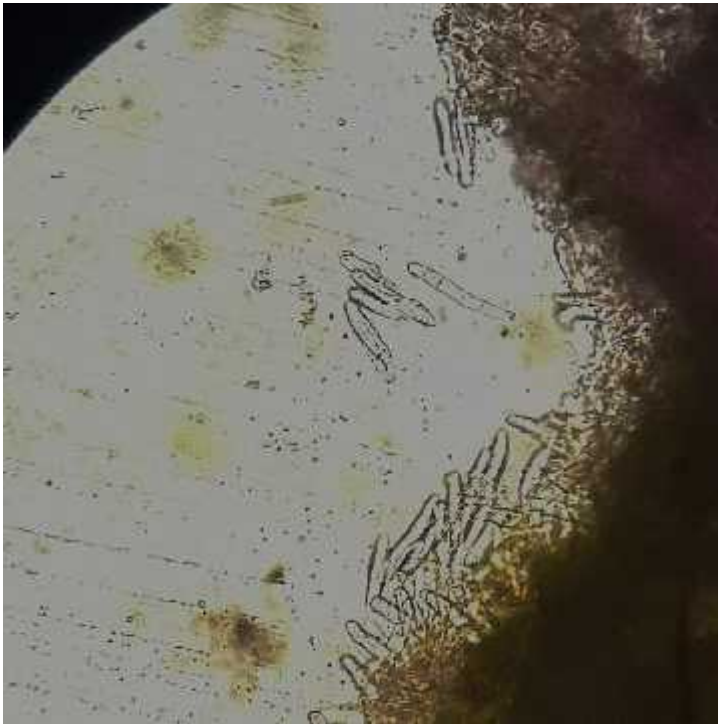
YIELD TRIAL 2016 - 2017

Promising clones :

- a) SL 35 (starch rendement 35%), SL 221, SL 26 (starch rendement = 27%)**
- b) MU 111 (root weight = 3425 g/plant ~ 68 ton/ha; 4217 kg/ha ~ 84 ton/ha) , starch rendement)**
- c) Bayam Liwa 4 (root weight = 4458 g/plant ~ 89 ton/ha**
- d) CMM 96-1-105 (root weight = 3741 g/plant ~ 74 ton /ha)**



Disease severity of Cercospora leafspot
and root rot



C. henningsii (400x)



Result of thogenicity test

Disease severity of brown leafspot

Klon	Waktu							
	16	18	20	22	24	26		
Batak TBB	7,1	ab	3,0	2,9	bc	4,6	4,7	5,5
Bendo 3A	5,6	ab	3,9	2,9	bc	5,9	2,3	4,7
BL-1A	6,9	ab	4,0	6,4	a	5,3	4,0	7,9
BL-2	8,2	a	5,6	4,3	ab	5,0	5,9	5,9
Cimanggu	9,5	a	4,2	4,3	ab	6,8	4,2	9,0
Duwet 3A	3,5	bc	2,1	0,8	d	2,1	3,1	3,7
GM-1	2,5	bc	2,7	4,5	ab	3,4	2,2	5,4
Mulyo 3	1,5	c	0,1	0,6	d	0,9	1,5	3,0
Sembung TBB	6,7	ab	4,8	2,9	bc	4,9	4,5	9,6
UJ 3	2,7	bc	2,0	2,0	cd	3,2	2,2	4,0
UJ 5	3,8	abc	1,3	2,4	bc	3,8	1,4	4,9
Fhitung	2,7*		2,0 ^{ns}	6,6*		1,5 ^{ns}	1,4 ^{ns}	0,9 ^{ns}
KK	23,2		9,2	17,8		14,0	9,0	11,3
BNT	0,94		0,3	0,55		0,4	0,26	0,4

Disease severity of brown leafspot

Batak TBB	4.7
Bendo 3A	4.2
BL-1A	5.7
BL-2	5.8
Cimanggu	6.3
Duwet 3A	2.5
GM-1	3.5
Mulyo 3	1.3
Sembung TBB	5.6
UJ 3	2.7
UJ 5	2.9



Root rot (possible pathogens: *Sclerotium rolfsii*, *Fusarium* sp.)

Disease incidence of root rot

(10 moths after planting)

Batak TBB	6,7
Bendo 3A	4,8
BL2	74,1
BL-1A	8,3
Cimanggu	0,0
Duwet 3A	10,4
GM-1	13,3
Mulyo 3	15,9
Sembung TBB	26,1
UJ 3	37,0
UJ 5	6,1

**Correlation disease intensity and
root weight per plant**

Penyakit	Bobot Ubi
Bercak Daun Coklat	0,30 ^{tn}
Bercak Daun Baur	-0,11 ^{tn}
Bercak Daun Bersudut	0,23 ^{tn}
Busuk Kering Ubi	-0,75*

Keterangan : * berpengaruh nyata,

^{tn} tidak berpengaruh nyata.

Conclusion

- Clones Mulyo 3 dan Duwet 3 showed disease severity of Cercospora brown leafspot (1.3 dan 2.5%) less than UJ 3 and UJ 5; overall, the disease severity of all 11 clones was less than 7%,
- Clones Cimanggu dan Bendo 3A showed disease severity of root rot (1.4 dan 1.7%) less than UJ 3 and UJ 5. Disease severity of BL 2 was 74% (very susceptible). Range of of disease severity of root rot all 11 clones was 0 – 74%.

Disease severity: mealy bug

Clones	Observation on -					
	16 WAP	18 WAP	20 WAP	22 WAP	24 WAP	26 WAP
..... %.....						
Batak	3,7 bc	32,4 a	55,3 ab	30,5 bc	12,2 abc	1,8 a
Bendo 3 A	7,4 abc	15,7 a	33,1 ab	22,8 bc	12,9 abc	5,5 ab
BL - 1A	9,7 ab	15,6 a	21,5 b	28,2 bc	7,2 bc	0 b
BL 2	11,1 ab	8 a	29,8 ab	21 c	7,3 bc	3,7 ab
Cimanggu	10 ab	22 a	39,8 ab	23,3 bc	7 bc	0 b
Duwet 3A	13,3 a	16,6 a	28,3 ab	39,2 bc	15,7 abc	5,2 ab
GM-1	7,4 abc	14,4 a	23,3 ab	17,2 c	3,7 c	1,8 b
Mulyo 3	7,2 abc	32,5 a	41 ab	70,6 a	18,1 ab	9,2 ab
Sembung	8,3 abc	14,2 a	23,3 ab	15,5 c	12,6 abc	1,6 b
UJ 3	5,4 bc	10 a	20 b	21,6 bc	19,2 ab	12,1 a
UJ 5	1,6 c	15,5 a	24,4 ab	21,6 bc	20,4 abc	12,9 b
LSD 5%	7,53	24,28	33,37	18,03	13,07	9,37

Disease severity: Mite (*Tetranychus* spp.)

Clones	Pengamatan ke-					
	20					
	16 WAP	18 WAP	WAP	22 WAP	24WAP	26 WAP
.....%						
Batak	39,8 a	39 ab	33,4 a	34,4 abc	26,6 a	22,5 ab
Bendo 3 A	32,6 bcd	35,1 ab	26,3 a	27,7 bc	23,3 a	20 b
BL - 1A	37,1 ab	33,3 ab	31,5 a	29,4 bc	19,2 a	21,3 b
BL 2	25,3 e	27,2 b	24,7 a	23,2 c	21,5 a	20,7 b
Cimanggu	27,3 ed	33,3 ab	31,4 a	23,3 c	20 a	20 b
Duwet 3A	29,3 ecd	32,6 ab	28 a	26,3 bc	23,6 a	21,4 ab
GM-1	30 cde	33,5 ab	27,6 a	21,3 c	28,1 a	23,7 ab
Mulyo 3	36 abc	30,1 ab	35,3 a	39 abc	29,2 a	20 b
Sembung	36 abc	35,3 ab	24,6 a	26 bc	25,3 a	20 b
UJ 3	28,3 ed	32,8 ab	31,6 a	29,4 bc	29,2 a	22,3 ab

Population of mites (Tetranychus spp.)

Clones	Observation					
	16 WAP	18 WAP	20 WAP	22 WAP	24 WAP	26 WAP
.....Individu/ 3 leaves.....						
36-Daniel	23,4 bcde	18,3 bc	6,3 cde	4,4 c	7,1 d	4,4 bcd
40-Daniel	34,4 b	21,7 bc	14,1 b	13,9 ab	15,2 bc	5,4 bcd
Batak	20,4 cde	16,3 bc	6,2 cde	17,9 a	16,2 b	7,3 b
BL 2	25,8 bcd	25,2 bc	12,4 cb	4,7 c	11,8 bcd	3,6 cd
Cimanggu	15,2 ed	19,1 bc	4 e	8,6 bc	7,2 cd	5,6 bcd
GM-1	13,1 ed	15,7 bc	6,6 cde	5,2 bc	6,5 d	4 cd
Mulyo 3	50,8 a	47,2 a	22,1 a	8,6 bc	25,4 a	11,4 a
Sembung	24,3 bcde	22,8 bc	4,6 ed	9,1 abc	14,3 bcd	5,3 bcd
UJ 3	12,3 e	23,7 bc	9,1 bcde	4,1 c	8,6 bcd	4,1 cd
UJ 5	19,4 cde	8,8 c	6,3 cde	8,3 bc	10 bcd	3,4 d
LSD 5%	13,4	17,72	7,21	9,1	8,1	3,28

Promising clones in pipeline

- a) **SL 35 (starch rendement 35%), SL 221, SL 26 (starch rendement = 27%)**
- b) **MU 111 (root weight = 3425 g/plant ~ 68 ton/ha; 4217 kg/ha ~ 84 ton/ha) , starch rendement)**
- c) **Bayam Liwa 4 (root weight = 4458 g/plant ~ 89 ton/ha**
- d) **CMM 96-1-105 (root weight = 3741 g/plant ~ 74 ton /ha)**
- e) **Clones suitable for leaf vegetables**
- f) **Clones suitable for artificial rice (analog)**
- g) **Clones for waxy cassava, biodegradable plastics**