PRODUCTIVITY IMPROVEMENT OF *Jatropha curcas* L THROUGH MOLECULAR BREEDING

ROBERDI
NURITA TORUAN-MATHIUS
YOGO ADHI NUGROHO
ROY HENDROKO

BIOTECHNOLOGY LABORATORY
PLANT PRODUCTION AND BIOTECHNOLOGY DIVISION
PT. SMART Tbk
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Background

- For developing a variety required plant material genetics
- There are two kinds of genetic materials sources:

1. Germplasm collection (33 accessions)
   from several provinces in Indonesia with different agro climate and from overseas as a genetic resources not characterized yet

2. Improvement Provenance (IP-2P and IP 3)
   IP-2P has high yield potent 6 ton/ha/year

Background

❖*Jatropha* breeding program in Indonesia to produce elite varieties just started.

❖Conventional and molecular breeding are carry out simultaneously to shorten breeding period using:

- *Bulk Segregant Analysis* (BSA) is a shortcut method to find marker linked with desired traits
- Marker linked with trait applicable for *Marker Assisted Selection* (MAS) program

Problem solving

There is a need for

➢ Characterization of existing germplasm of *Jatropha* for seed yield, oil content and others parameter

➢ Molecular characterization of the existing germplasm using *Amplified Fragment Length Polymorphism* (AFLP) marker

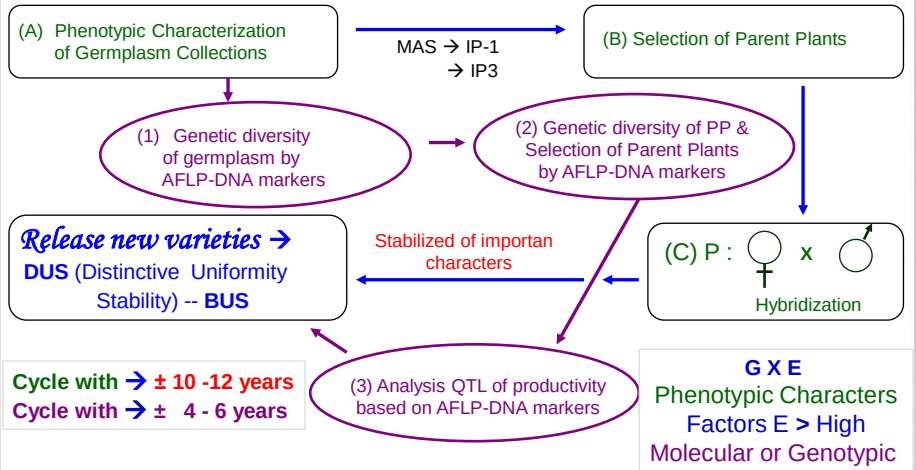
Parameters of Characterization

No	Criteria	Germplasm	IP-3
1	Seed Yield	X	√
2	Oil Content	X	X
3	Pest and Disease Resistance	X	X
4	Drought Tolerance	X	X
5	Genetic Similarities	X	X

√ = in progress

X = not characterized yet

Molecular Breeding of Jatropha Curcas



Shorten time consuming for breeding cycle by AFLP-markers

Objectives

1. Obtaining candidate plants based on parameters of characterization
2. Genetic similarities among germplasm accessions and IP-3
3. Obtaining inbred lines for each parameter of characterization
4. Obtaining molecular marker linked to desired traits

Materials and Methods

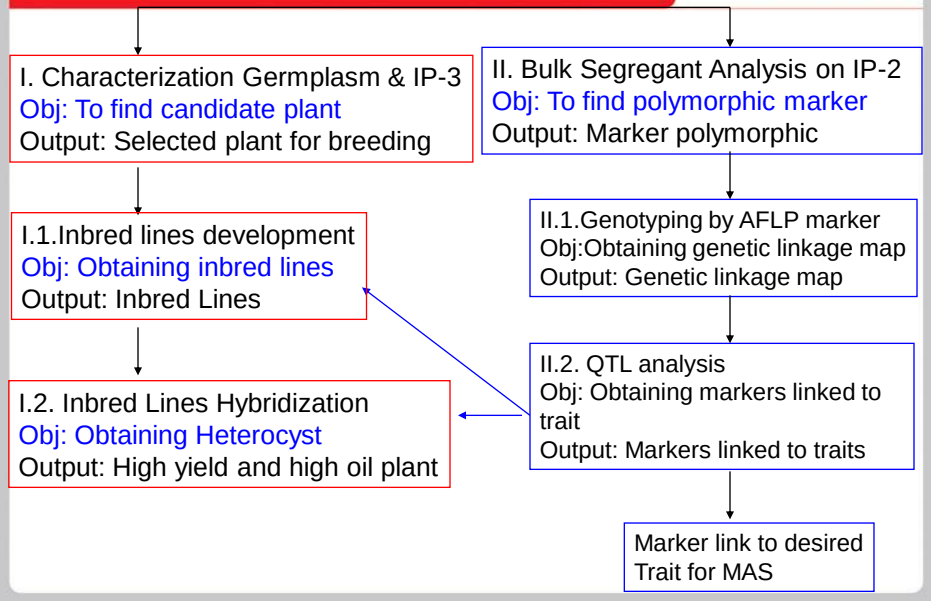
- 33 germplasm accession, IP-2P and IP 3P
- AFLP marker
- Oil extraction apparatus

- Research duration : 3 years (2009 – 2011)

Place

Jatropha plantation PT Bumi Mas Eka Persada at Cikarang 30 Ha
Biotechnology Laboratory PT SMART Tbk, Bogor

Research Flow Chart



Methodology

Year I
1. Characterized germplasm and IP-3
2. Bulk Segregant Analysis
3. Genetic similarities by molecular marker

Year II:
1. Continuing germplasm characterized and IP-3
2. Inbred Lines Development
3. Genotyping and QTL analysis

Year III
1. Inbred Lines Development
2. Genetic similarities by molecular marker

1. Yield recording of *Jatropha curcas*

Yield components:

1. Number of capsules/shrub (pcs)
2. Weight of capsules/shrub (g)
3. Weight /capsule (g)
4. Number of seeds/shrub (pcs)
5. Weight of 1000 seeds (g)
6. Number of seeds/capsule (pcs)
7. % seed/capsule (%)

2. Oil Content

Weighing 10 g blended seed,
Put into the thimble

↓

Extract with 150 mL n-Hexane for 6 h

↓

Remove the thimble from apparatus

↓

Dry extract at 103° C for 2 h
Put in desiccator for 30'

↓

Weighing 2.5 g

Oil content (%)=*m1/m0* x 100
m0=mass of the test portion (g)
m1= mass of the extract found in the flask after drying (g)

Continued

2. Oil Content

- **Low oil content :**
  <30 % seed oil/ < 50 % kernel oil content
- **Moderate oil content:**
  30-35 seed oil content/50-55 kernel oil content
- **High oil content:**
  >35% seed oil/ >55 kernel oil content

3. Drought Tolerance

Trial I : To confirm permanent leaf wilting point

Randomize Complete Group design

Factor I : Selected plant and control

Factor II : Water stress period (0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30 days) @ 3 plants (2x3x11= 66 plants)

Variable responses :

Leaf water potential, leaf water content, relative water content, specific leaf area, soil water content

Continued

3. Drought Tolerance

Trial II : Physiological and biochemical response

Random Complete Group design

Factor I : Selected plants and control (4 month old)

Factor II : Water stress period (confirm after trial I)

Variable responses : Leaf water potential, leaf water content, relative water content, specific leaf area, soil water content, proline, glycine-betaine, & SDS PAGE

Data Analysis : ANOVA and Duncan (SAS program)

4. Pest and Disease Resistance

Disease and pest incidence, will be scored

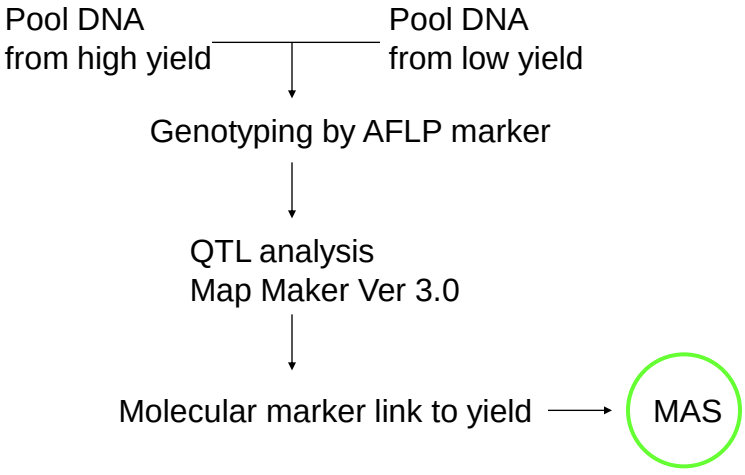
0 = no disease/pest incidence
1= 0 < leaf incidence ≤ 20%
2= 20% < leaf incidence ≤ 40%
3= leaf incidence >40%

$$\text{Disease Incidence (DI)} = \frac{n1(1) + n2(2) + n3(3)}{(n1 + n2 + n3)(3)}$$

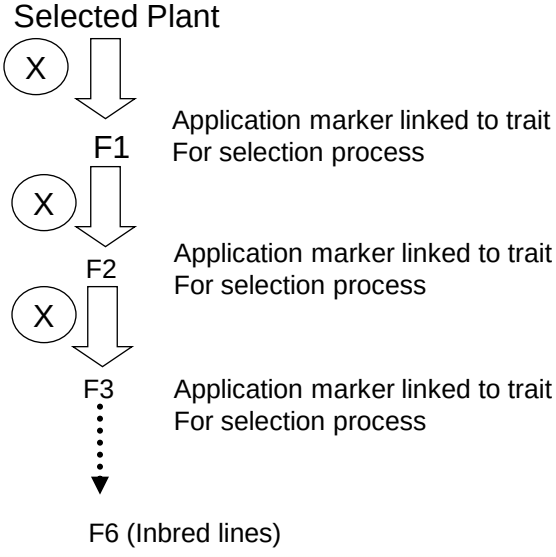
n1 = number of plant with score 1
n2 = number of plant with score 2
n3 = number of plant with score 3

Scoring system depend on disease in the plantation

5. Bulk Segregant Analysis of IP 2



6. Inbred Lines Development



TIME SCHEDULE

No	Activities	Year/Semester					
		I		II		III	
		1	2	1	2	1	2
1	Characterization						
	Seed yield	X	X				
	Oil Content	X	X				
	Pest & Disease	X	X				
	Drought			X			
	Genetic distance	X	X			X	
2	BSA	X	X	X			
3	Inbred Lines Dev				X	X	X

Research Team

No	Name	Academic Title	Graduated From	Background
1	Roberdi	M.Si	Bogor Agricult Univ	Plant Biotechnology
2	Nurita Toruan-Mathius	Dr	Bogor Agricult Univ	Plant Biotechnology
3	Yogo Adhi Nugroho	S.P	Bogor Agricult Univ	Plant Breeding
4	Roy Hendroko	Dr	Gajah Mada Univ	Agronomist

Thank you
For your attention