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HYBRID RICE ADOPTION IN INDONESIA : THE SUCCESS AND CHALLENGES

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INDONESIA SUCCESS STORY IN RICE

- Indonesia reached rice self sufficiency in 1984
- Determinant factors :
  - Improvement of food crop technologies (green revolution)
  - Investment of infra-structure and irrigation
  - Development of informal education /training farmers skill e.g : Farmer Forum
  - Price regulation policy through BULOG

Adoption of High Yielding Varieties

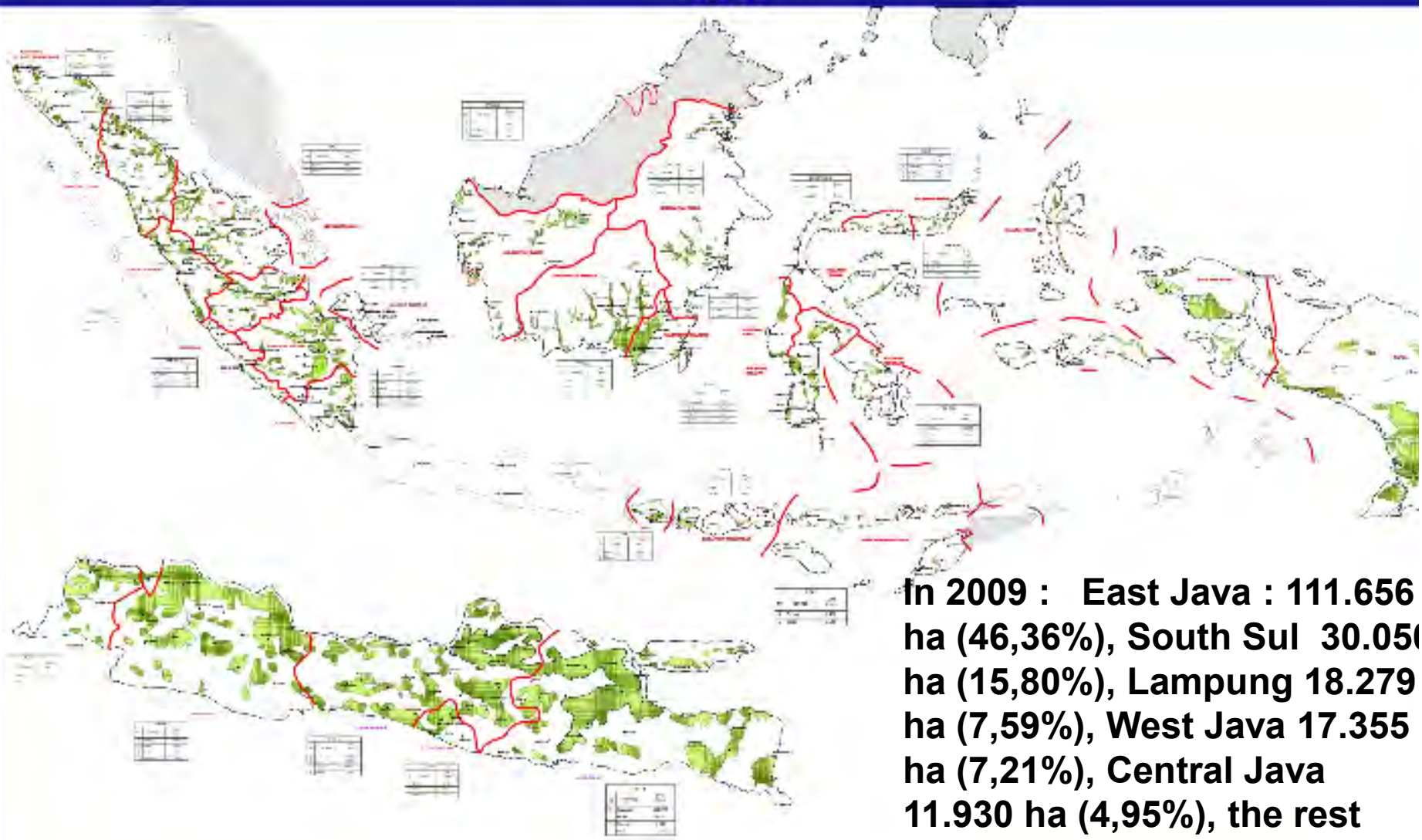
Varieties	Released Year	Adoption (% from total planted area)			
		2005	2006	2007	2009
IR 64 *	1984	31,43	23,60	17,09	10,50
Ciherang	2000	21,84	31,30	41,49	47,63
Local Var	-	12,85	-	-	8,44
Ciliwung	1989	7,95	3,25	3,97	4,38
Lines	-	5,11	-	-	-
W. Apo Buru	1998	3,30	2,32	-	-
IR 42 *	1988	2,44	1,19	-	1,35
Widas	1999	1,77	-	-	-
Memberamo	1995	1,64	1,82	1,75	-
Cisadane	1980	1,61	3,75	-	-
IR 66 *	1995	1,13	-	-	-
Cisokan	1985	1,09	-	-	-
Cibogo	2003	1,06	3,25	4,21	3,56
Cigeulis	2002	-	-	5,06	5,17
Cisantana	2000	-	-	2,73	-
Others	-	**28,73**	**29,82**	**17,49**	**15,43**

* Introduced from IRRI

TECHNICAL CONSIDERATION OF USING HYBRID RICE IN INDONESIA

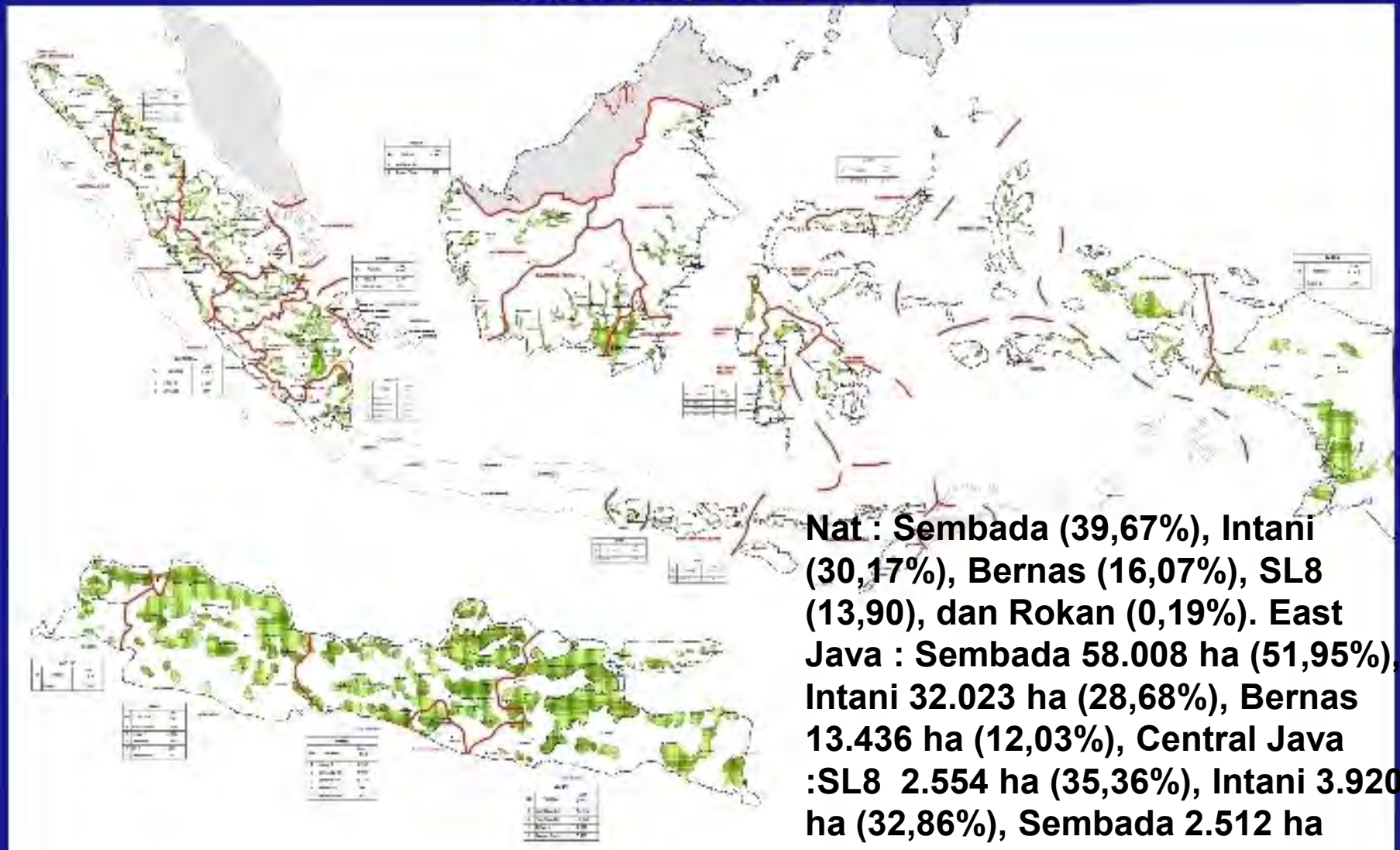
- Plateuing of modern inbred rice varieties
- Indonesia is one of the potential Asian countries for developing hybrid rice
- Possibility for developing new plant type hybrid
- Hybrid rice development in some tropical countries is prospective

PETA PENYEBARAN VARIETAS PADI HIBRIDA EXISTING 2009



In 2009 : East Java : 111.656 ha (46,36%), South Sul 30.05(ha (15,80%), Lampung 18.279 ha (7,59%), West Java 17.355 ha (7,21%), Central Java 11.930 ha (4,95%), the rest was in other 19 provinces

PETA PENYEBARAN VARIETAS PADI HIBRIDA EXISTING JANUARI S/D JULI 2010



Nat : Sembada (39,67%), Intani (30,17%), Bernas (16,07%), SL8 (13,90), dan Rokan (0,19%). East Java : Sembada 58.008 ha (51,95%), Intani 32.023 ha (28,68%), Bernas 13.436 ha (12,03%), Central Java :SL8 2.554 ha (35,36%), Intani 3.920 ha (32,86%), Sembada 2.512 ha (21,05%).

THE SUCCESS AND CHALENGE OF HYBRID SEED PRODUCTION

- The success of hybrid rice technology depend on the efficient and economical seed production in commercial scale

- Availability, quality, and price of hybrid rice seed determined adoption level

Predicted Suitable Area for Producing F1 Hybrid Rice Seed

- Medium altitude (100 s/d 500 m dpl)
- Relative humidity 70 -80%
- Daily temperature (24-28˚C); max temp < 32 ˚ C;
- night –day temperature difference (8-10˚C)
- Sunny
- Wind velocity (10-15 km/h)
- No rain during flowering time
- Fertile (pH neutral)
- Responsive farmer

District	Province	Seed production done in the district
Bukittinggi	W. Sumatera	KNBM
Siak Inderapura	Riau	KNBM
Lampung	Lampung	SAS
Karawang	W. Java	SAS
Sukamandi	W. Java	ICRR, SHS
Sidrap	South Sul	SHS-SL Agrictech
Bantul	Yogyakarta	Syngenta
Salatiga	C. Java	Primasid
Tegalgondo	C. Java	Prov. Seed Farm
Banyudono	C. Java	Prov. Seed Farm
Sragen	C. Java	BISI
Malang	E. Java	Dupont, Syngenta
Mojokerto	E. Java	Dupont, MSNT
Lombok	West NT	MSNT
Situbondo	E. Java	Dupont
Kediri	E. Java	BISI

CHOISE OF PLANTING SEASON

Dry Season (April – September) because :

- Dry conditions
- No rain during the flowering period
- Wind velocity optimal
- Sunny
- Less pest and diseases

IMPORTED F1 HYBRID AND PARENTAL LINES SEED DURING THE PERIODE OF 2005-2010

Year	Seed Imported			
	F1 Hybrid		Parental lines	
	ton	%	ton	%
2005	10.42	58.54	6.75	54.00
2006	102.14	76.08	8.05	48.94
2007	3,973.00	87.03	13.60	59.91
2008	3,321.50	84.61	32.81	82.64
2009	4,868.79	87.87	30.10	53.01
2010	3,364.15	66.62	2.13	2.18
Total	**15,640.00**	**81.32**	**93.44**	**38.04**

- Hybrid rice seed production is skill oriented activity so technology transfer is a must to quarantine high seed yield
- Heterosis level and hybrid rice adoption in commercial level is depend on the ability to produce F1 hybrid seed good quality in the big amount

Seed yield of Maro in Pusakanegara , West Java, 2002 DS

Leaf Clipping	Supplementary Pollination	Flowering Synchronized	Seed yield (Kg/Ha)
No	Blower	80 %	1673
Clipping	Blower	80%	1728
Clipping	Bamboo stick	30%	656
No	Blower	80%	1451

THE SUCCESS OF SEED PRODUCTION (≥ 1.5 t/ha in the commercial scale)

SEED PRODUCTION OF HYBRID RICE DEVELOPED BY ICRR

SEED GROWER	LOCATION	SEASON	VARIETY	SEED YIELD (KG/HA)
BB Padi	Muara, Bogor	2006 DS	Maro	1100
PT Syngenta	Bantul	2007 DS	Hipa3	1057
BB Padi	Sukamandi, Subang	2008 DS	Hipa6 Jete	1800
PT Dupont	Krebet, Malang	2009 DS	Hipa8	2000
AIAT SUMUT	Medang Deras, Kab Batubara	2010/2011 WS	Hipa6 Jete	945
PT SBU	Maos Lor Cilacap	2011 DS	Hipa14 SBU	1700 kg/bahu

Seed Production of SL8 SHS variety

Year	Harvesting date	Areal (ha)	Seed yield	Seed yield (kg/ha)
2008	19-9-2008	2.00	2916	1458
		1.00	2215	2215
		1.00	2566	2566
		1.00	3919	3919
		1.00	2873	2873
	21-9-2008	2.00	4544	2272
		1.00	2779	2779
		1.00	2774	2774
		1.79	3460	
		0.50	756	1,620

Source : Sang Hyang Seri

Challenges and Alternative Solutions

Challenge	Alternative Solutions
• Sustainability of parents seed stock	1. Responsibility of NS/BS production and delivery through *paired crossing method* should be shouldered by institution released the hybrid 2. FS of parents of public hybrids must be always available; needs to develop institutions for this purpose
• Limited trained human resources	1. More orientation on practical matters, effective trainings for right seed growers must be better organized.
• Low seed production	1. Precise synchronization 2. Good agronomic management in each of seed productions blocks 3. All recommended packages should be implemented well.

Challenge	Alternative solutions
• Short storage period of F1 and parents seeds	1. Simple storage methods should be identified and adopted 2. Medium and long term seed storage facilities must be developed
• Consuming time of *Grow-out test*	1. Adoption of molecular techniques to test the purity
• High cost of seed production	1. Increase seed production by adopting all recommended seed production packages 2. Need to search and adopt cheaper alternatives of GA3 3. It is urgent to development of high out crossing potential of CMS

FUTURE PRIORITIES

- Seed yield average increase up to 2.0 t/ha
- Reduce production cost
- Identify of suitable area for seed production in commercial scale
- Educated human resources
- Motivated public seed grower for more contributed

THE SUCCESS AND CHALENGE OF HYBRID RICE CULTIVATION

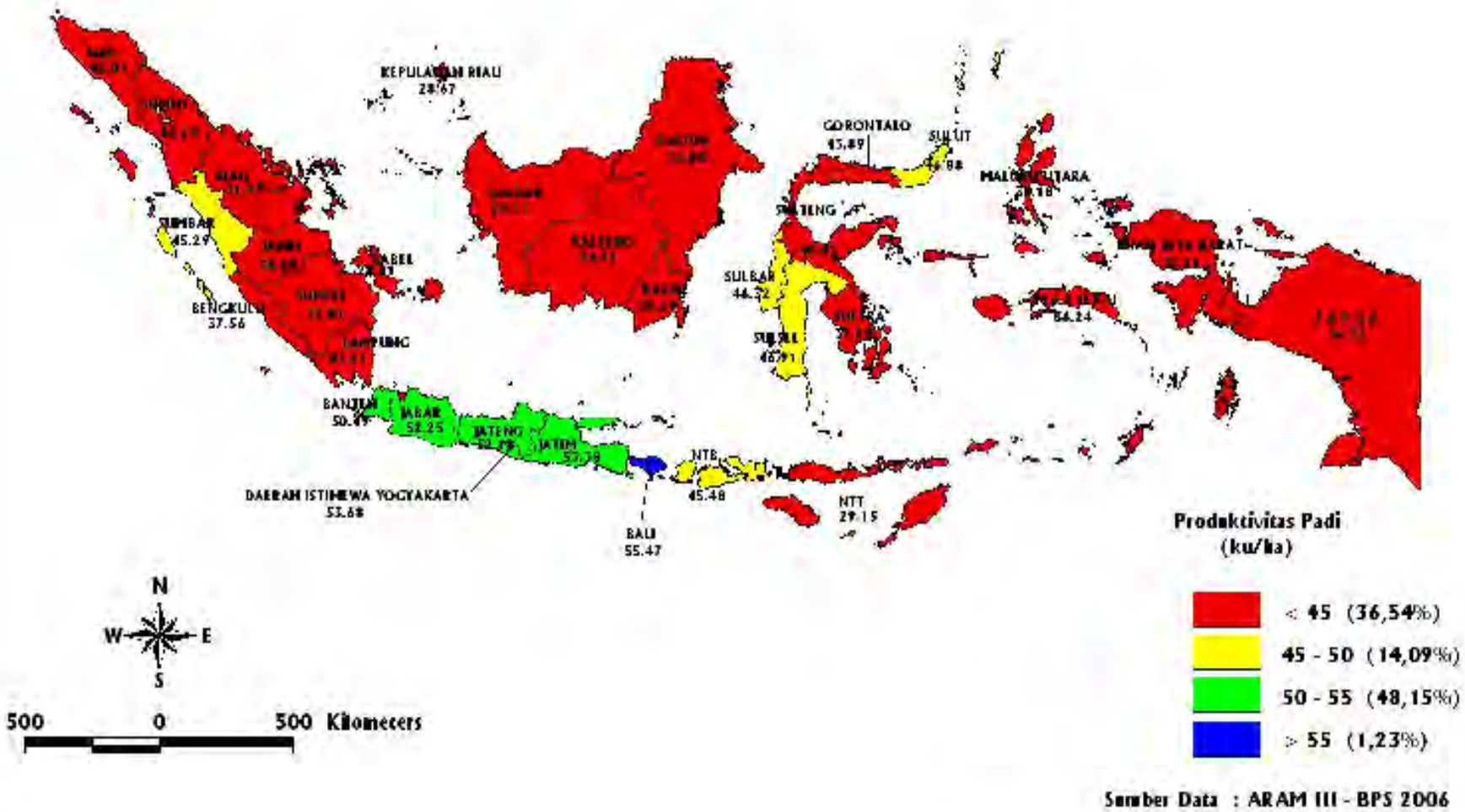
- Suitable Areal 1.6 M ha
- Cultivation technology available
- High yield potential
- 71 hybrid rice varieties
- Increasing of productivity
- Increasing national rice production
- Collaboration with private companies

DEVELOPMENT AREA

Hybrid rice can be grown as low land rice in both low and medium altitude with the following conditions :

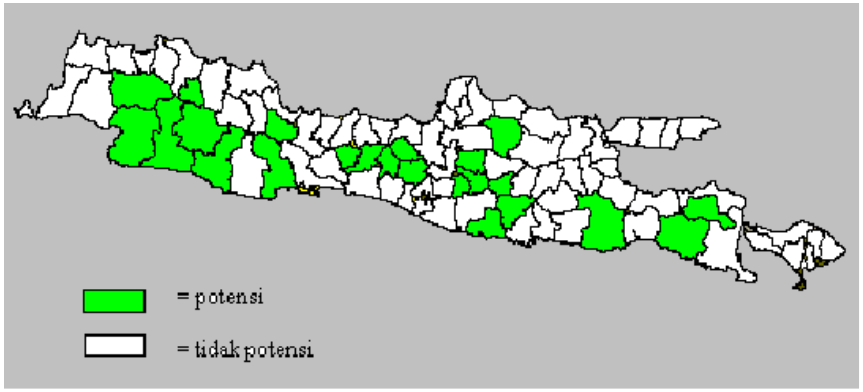
- Good irrigation and drainage system
- Light-medium soil texture
- Appresiative and responsive farmer

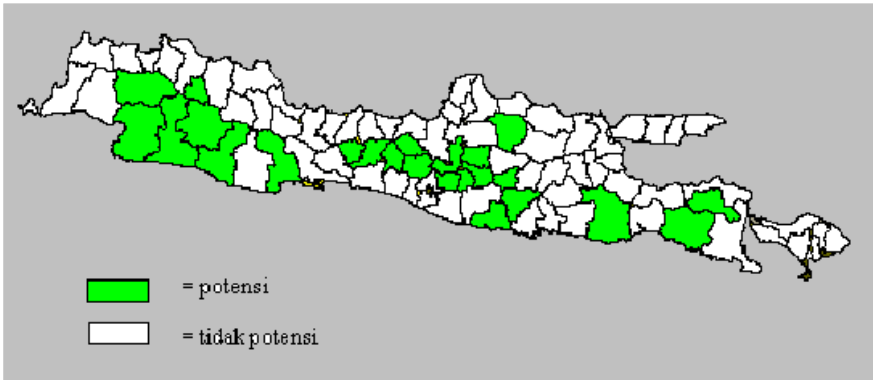
PRODUKTIVITAS PADI
DI INDONESIA -TAHUN 2006



POTENTIAL DEVELOPMENT AREA FOR HYBRID RICE IN JAVA AND BALI

- Potential development area for hybrid rice in Java and Bali duirng DS (33 district → 1,611,960 ha = 32% total irrigation area).
- Potential development area for hybrid rice in Java and Bali during WS (23 district → 1,655,162 ha = 33 % total irrigation area)





INSTITUTION	NO	HYBRID RICE VARIETIES RELEASED IN INDONESIA
BB PADI	**17**	**Maro, Rokan, Hipa 3, Hipa 4, Hipa 5 Ceva, Hipa 6 Jete, Hipa7, Hipa8, Hipa9, Hipa10, Hipa11, Hipa12, Hipa13, Hipa14, Hipa15, Hipa16, Hipa17**
BISI	4	Intani 1, Intani 2, Intani 301, Intani 602
Bangun Pusaka	2	LP Pusaka 1, LP Pusaka 2
Kondo	5	Miki 1,2,3; Manis 4 & 5
Bayer Crop Sci	4	Hibrindo R1, Hibrindo R2, TEJ, 6444
KNB Mandiri	2	Batang Kampar, Batang Samo
Dupont	2	PP-1, PP-2
Makmur SNT	2	Brang Biji, Segara Anak
TU Saritani	2	Adirasa-1, Adirasa-64
PT SHS and partner	11	SL8, SL11, WM2, 3, 4, 5, DG1 and 2, BSH1,3, and 6
Primasid	2	Mapan-P.02, Mapan-P.05
SAS	6	Bernas Super, Bernas Super2, Bernas Prima, 2, 3, 5
Biogene Plantation	6	Sembada B3, SB-5, SB-8, SB-9, S 101, S168
Agri Makmur Pertiwi	2	Rejo 1, Rejo2
Metahelix	2	DR1, DR2
Advanta	2	PAC801, PAC809
Total	**71**	**21 Varieties developed in Indonesia, 50 introduced from China and**

DATA TAKEN FROM ON FARM TRIALS ICFORD 2003

Number of location	**:**	**14 kabupaten**
Yield average of Maro	**:**	**7.3 t/ha**
Yield average of Rokan	**:**	**7.5 t/ha**
Heterosis range	**:**	**-11% to 46% (14%)**
Attainable yield of Rokan	**:**	**11.06 t/ha**
Attainable yield of Ciherang	**:**	**9.60 t/ha**
Hybrid rice yield range	**:**	**5.52 - 11.06 t/ha**

Grain Yield of some released hybrid rice varieties in the farm level, Mernek, Maos, Central Java CS II 2011

Variety	Area (ha)	Farmer	Yield (Kg)	Average (kg)	% MC	Yield (t/ha)
Mapan 02	0.105	Waluyo	18.8	18.96	24.2	7.584
			19.135		23.85	
Mapan 53	0.105		21.3	19.9	18.36	7.960
			18.62		19.75	
Mapan 05	0.105		24.82	30.41	25	12.164
			36		28.96	
Hipa 8	0.35		19.99	22.05	29.06	8.820
			24.11		31.5	
Hipa 11	0.35	Barjan	19.7	19.9	26.65	7.960
			19.5		22.9	
Hipa 8	0.35		23.12	21.81	21.9	8.724
			20.5		22.9	
Hipa 11	0.35	Kuswanto	21.51	20.605	22.23	8.242
			19.7		20.4	

Grain yield of some released hybrid rice varieties, Mernek, Maos, Central Java CS I 2011

Variety	Area (ha)	Farmer	Yield (Kg)	Yield (t/ha)
Hipa 11	0.107	Kuswanto	1030	9.926
Hipa 8	0.07		669	9.554
Inpari 13 (inbred)	0.178		1540	8.617
Inpari 10 Laeya (Inbred)	0.357		2302	6.448
Hipa 11	0.085	Waluyo	783	9.212
	0.01428		1552	10.868
Hipa 8	0.357		3342	9.361
	0.285		2310	8.105
PP 1	0.017		970	9.053
Logawa (Inbred)	0.7		5.482	7.831

Performance of ICRR hybrid rice in the farmer field

YIELD INCREASING AND FARMER'S INCOME , CIANJUR WEST JAVA, WS 2010-2011

GRAIN YIELD (KG)

Farmer	area (Ha)	Hybrid	Inbred	Yield increase (%)
Barnas	3.5	24 173	21 000	15
Samsudin	1.25	9 073	6 285	44
Saepulloh	0.15	1 200	800	50

FARMER INCOME (IDR)

Farmer	Area (Ha)	Hybrid	Inbred	Income increase (%)
Barnas	3.5	26 987 000	20 277 000	33
Samsudin	1.25	22 804 500	16 277 000	40
Saepulloh	0.15	3 000 000	2 240 000	34

THREATS

- Pests and diseases (BPH, BB, RTV, stem borer, rat)
- Identical cytoplasmic of the CMSs among hybrids
- Highly fluctuating temperature→ affecting seed production
- Expensive seed price
- Effect of global climate change (rainfall during flowering period) → affecting seed production
- Habit of farmers to use previous seed
- Limited suitable area for hybrid

Challenges

- Too high expectation of farmers
- Some hybrid had less superiority in quality aspects compared to the best inbred
- Not consistent of plant performance due to un-appropriate agricultural practices
- Less resistances
- Seed quality, especially in term of purity and viability
- High cost but not stable yield of seed production

IDENTIFIED PROBLEMS FOR FURTHER RESEARCH

- Not stable expression of heterocyst → increase location for early yield trials to identify more stable hybrid
- Most of the released variety in Indonesia are poor in resistance to BPH, BB, and Tungro→ affecting to the expression of heterosyst and become obstacle in adoption by farmers
- Grain quality→ exp. Rendement, broken rice, grain shape, chalkiness
- Development of indica x japonica or indica x javanica hybrids

CONCLUTIONS

- Seed System and technology had been developed, but not optimal yet
- Released hybrid varieties are mostly susceptible to major pests and diseases in Indonesia
- High expectation from farmers
- Not stabile performance due to different agricultural practices and un-appropriate environment
- Pure seed of parents and F1s some time are not avaiable
- Not so stable yield and expensive seed price
- Habit of farmers to use seed from previous cropping (F2)

CONCLUTIONS

- There are 5 key factors for Hybrid Rice Decvelopment, i.e.:
  - Right variety
  - Good quality seed
  - Good agricultural practices
  - Suitable area
  - Farmers's eager.
- The future direction of hybrid rice development: to breed hybrid those are really adapted for Indonesia, resistant to major pests and diseases and better eating quality→ could be developed by utilizations of local germ plasm collections or combining of national and introduces lines.


BADAN PENELITIAN DAN PENGEMBANGAN PERTANIAN
BALAI PENELITIAN TANAMAN PADI
DI SUKAMANDI

THANK YOU