PEMBANGUNAN VARIETI DAN PEMBIAKBAKAAN JAGUNG BIJIAN

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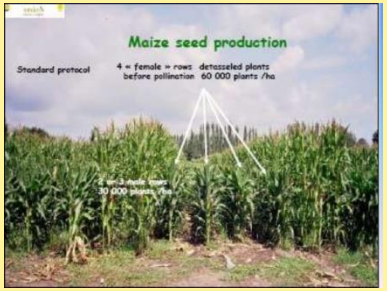
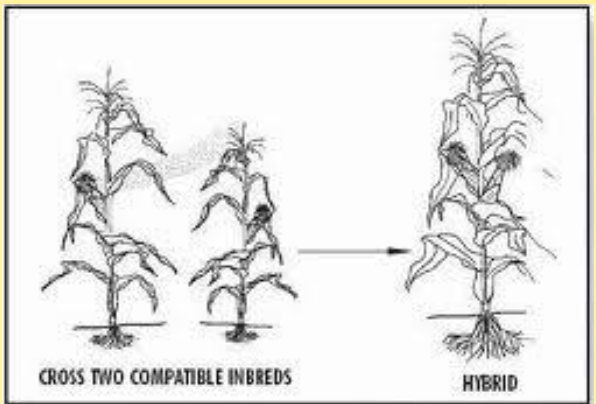




Rangka

1. Pengenalan : Tanaman Jagung dan Jagung Bijian
2. Kepentingan Pembiakbakaan dan Pembangunan Varieti
3. Pembangunan Varieti Jagung Bijian di Malaysia
4. Pembiabakaan Jagung Bijian di UPM
5. Penggunaan Varieti Hibrid Jagung Bijian di Negara Serantau
6. Kesimpulan

PENGENALAN

Jagung Sebagai Tanaman

- ✓ Tanaman ketiga paling utama di dunia selepas gandum dan padi
- ✓ Sebagai tanaman utama di 25 negara
- ✓ Tanaman paling banyak dikaji di dunia

Sejarah Domestikasi Jagung

- Berasal dari Mexico Tengah
- Bukti awal penanaman pada 8000 tahun lalu
- Mula disebarkan ke Amerika dan Canada.
- Disebarkan ke kebanyakan negara lain di awal tahun 1500an
- *Monospecific* .Tidak ada tanaman ‘saudara’ terdekat, melainkan dengan sedikit bukti pertalian dengan rumput ‘teosinte’

The Mayan corn god

Yam Kaax

Klasifikasi Jagung

- ✓ Jagung Flint (*Zea mays* L. covar. *vulgaris* Koern)
- ✓ Jagung Dent (*Zea mays* L. covar. *dentiformis* Koern)
- ✓ Jagung Tepung (*Zea mays* L. covar. *amylacea* Koern)
- ✓ Jagung Manis (*Zea mays* L. covar. *saccharata* Koern)
- ✓ Jagung Bertih (*Zea mays* L. covar. *microsperma* Koern)
- ✓ Jagung Sayur

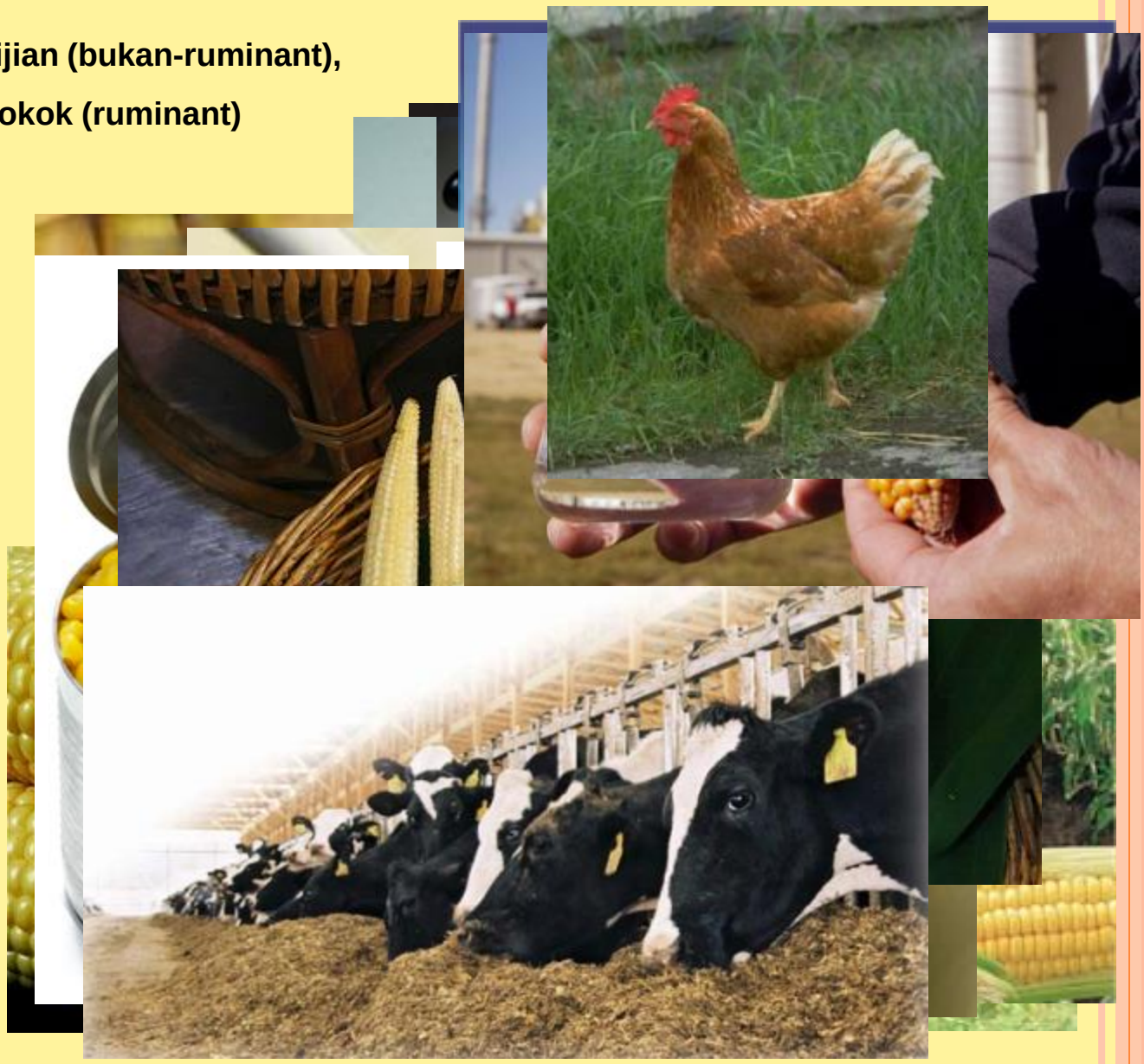
Sweet corn

Pop corn

Baby corn

Kegunaan Jagung

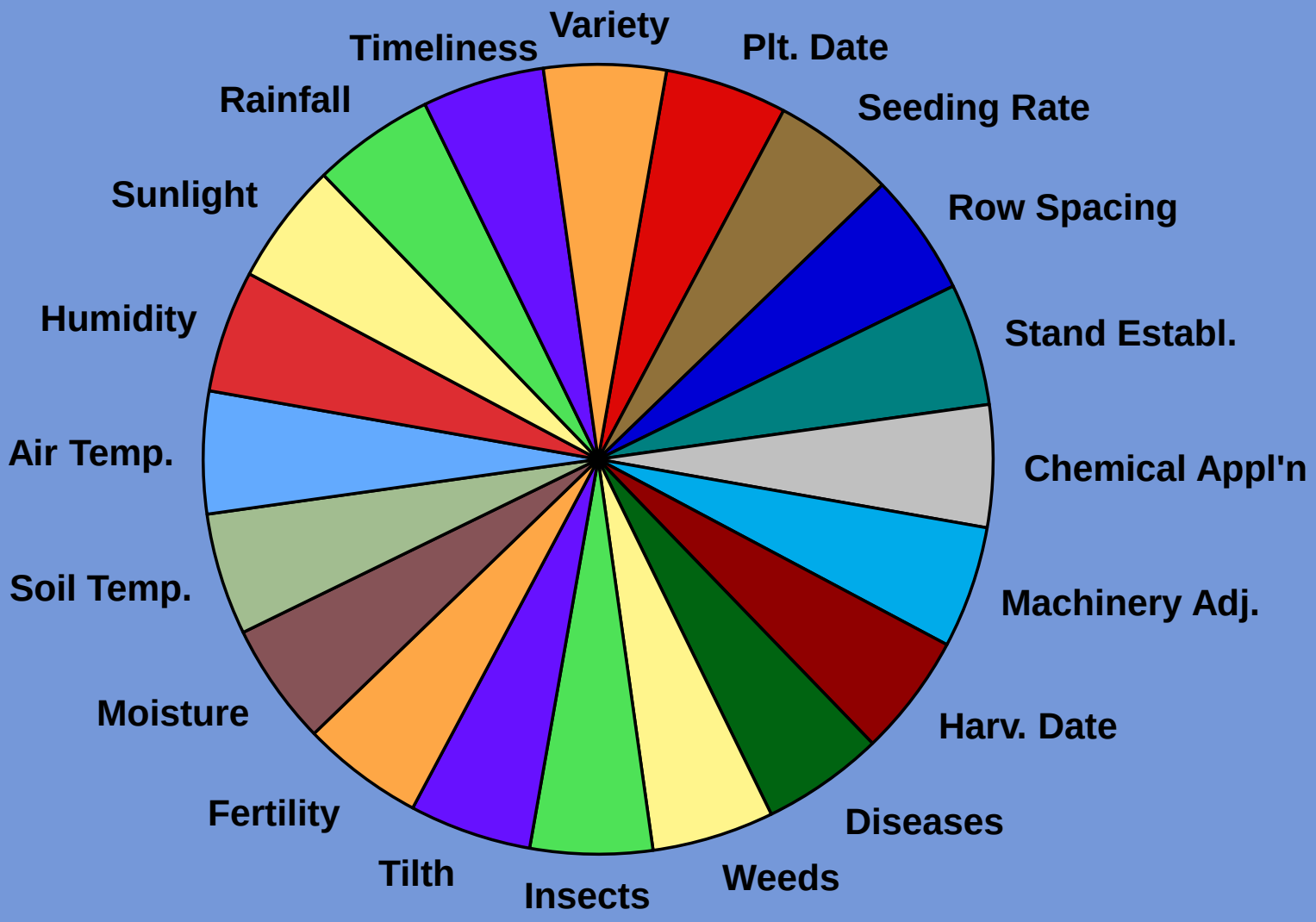
- ✓ Makanan ternakan – bijian (bukan-ruminant),
  - pokok (ruminant)
- ✓ Sirap – tinggi fruktos
- ✓ Tepung
- ✓ Minyak masak
- ✓ Jagung tongkol
- ✓ Jagung dalam cawan
- ✓ Jagung krim
- ✓ Jagung tin, sejukbeku
- ✓ Sayur
- ✓ Ethanol



Faktor Huluan Utama Pengeluaran Tanaman

- ✓ **Benih atau Baka yang Unggul**
- ✓ **Persekitaran yang Kondusif**
- ✓ **Amalan Penanaman yang Baik**

Faktor Penentu Pengeluaran Hasil Jagung Bijian



Pembiakbakaan Tumbuhan & Kepentingannya

- ***Bidang sains gunaan yang melibatkan proses merubah kandungan genetik (genotip) tumbuhan kepada yang lebih baik*** untuk kegunaan manusia (P = G + E)
- Mewujudkan ciri-ciri baru pada tanaman
- Pendekatan Pembiakbakaan:
  - Konvensional
    - Kacukan dan Pemilihan
    - Mutasi
  - Manipulasi Genetik Secara Bioteknologi
    - Pembiakbakaan Berbantu Penanda Molikul
    - Modifikasi Genetik/ Transgenik (GMO)
    - Manipulasi *In-vitro*

❖ **Menghasilkan Benih Varieti Baru Tanaman**

Hubungan antara Fenotip, Genotip dan Persekitaran

FENOTIP (P) = GENOTIP (G) + PERSEKITARAN (E)

- **Produktiviti**

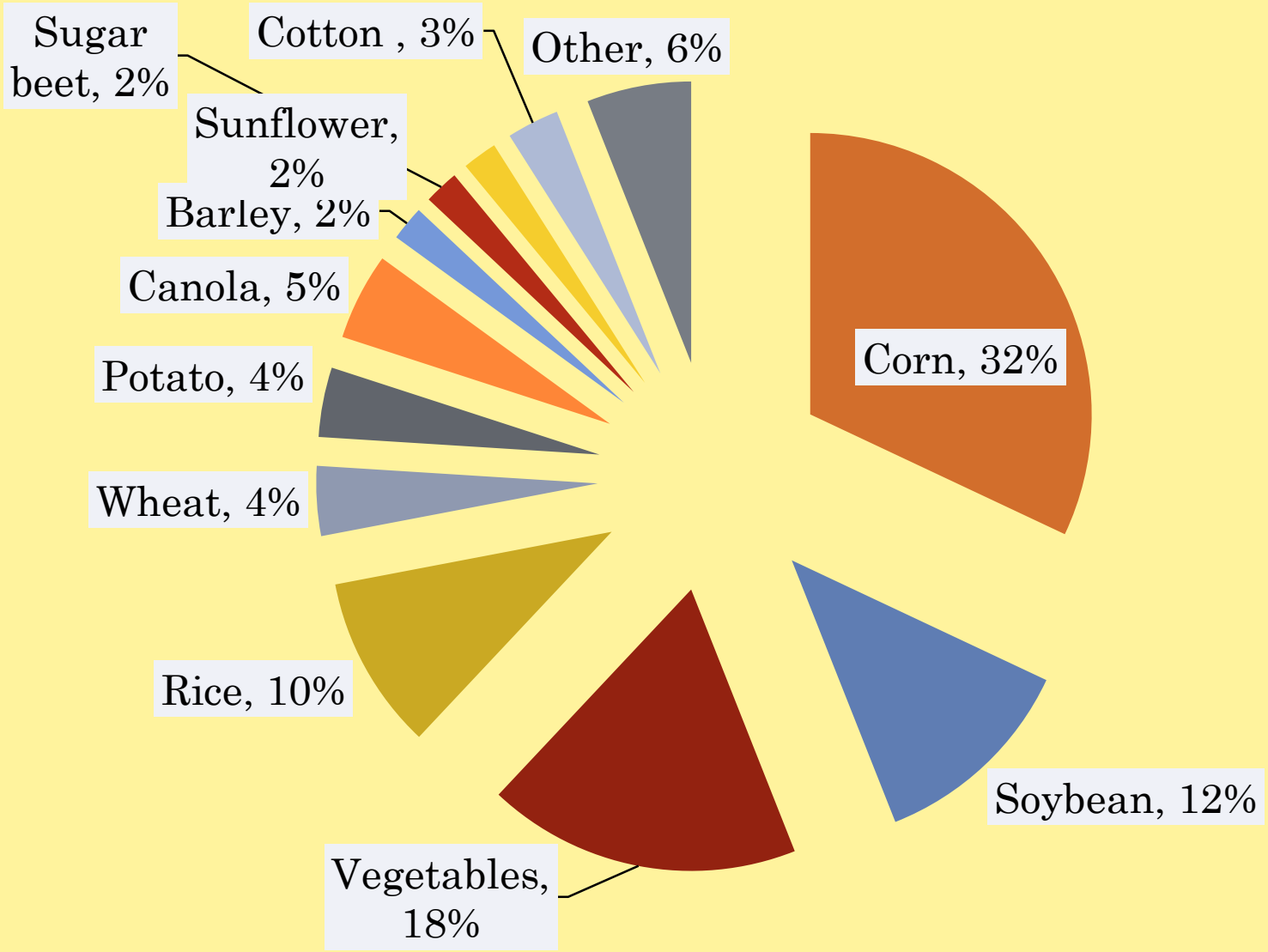
- **Varieti/Baka;**
  - **Pembiakbakaan**
  - **Pembaikan Genetik**

- **Pengurusan Baja/Pemakanan**
- **Pengurusan air**
- **Teknologi tepat**
- **Teknologi lepas tuai**
- **Pengawalan serangga/perosak**
- **Pemprosesan**

\+ G X E

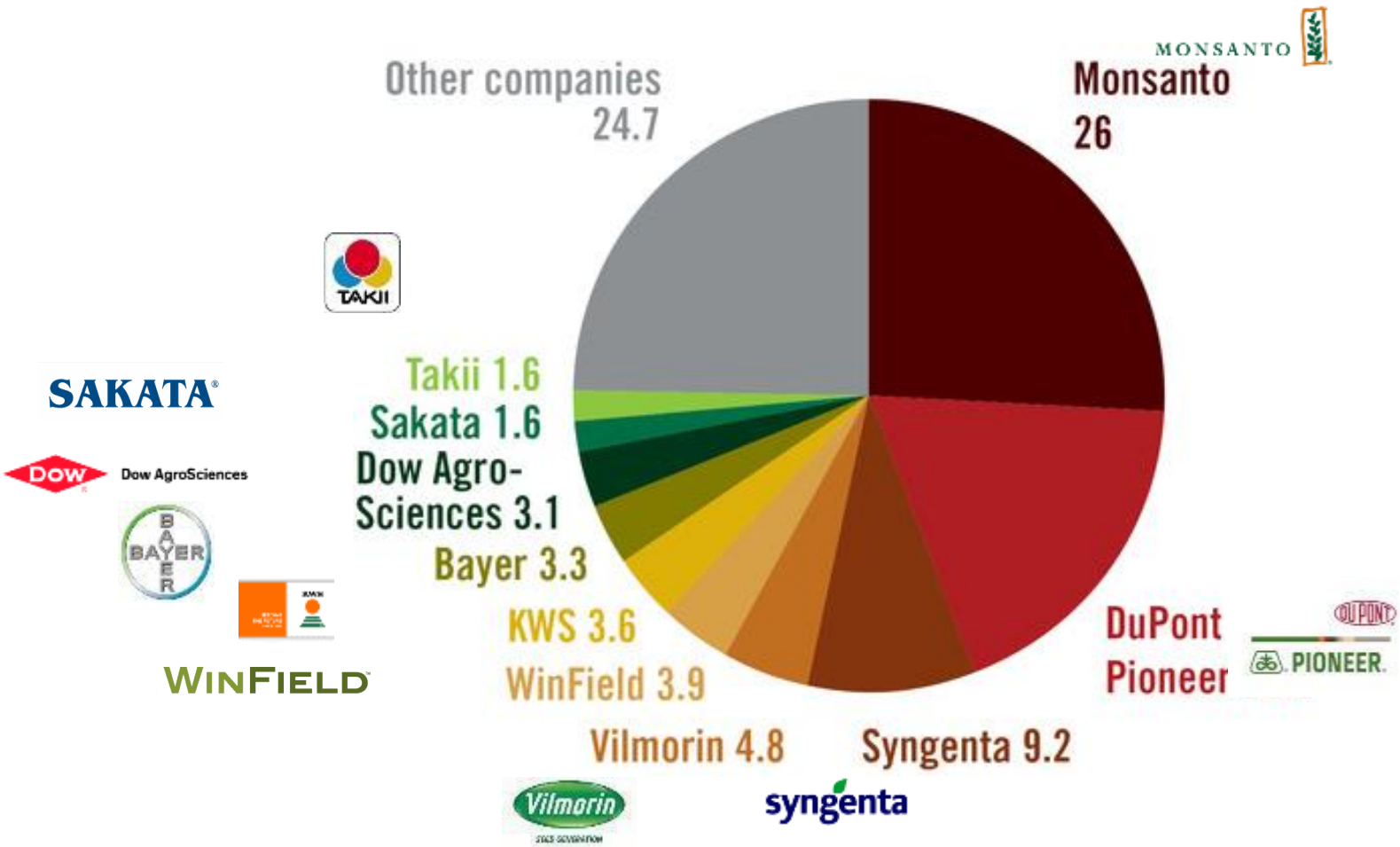
**Perlu difahami oleh semua pengamal penanaman jagung bijian

Pasaran Benih Dunia, 2013 (%)



Sumber: ETC Group, 2013

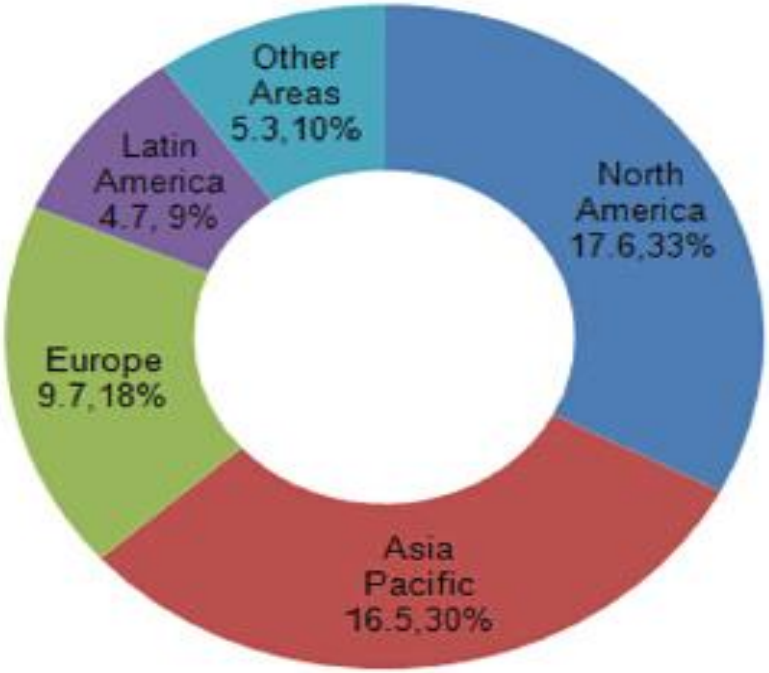
Syarikat Utama Pengeluar Benih Dunia, 2013 (%)



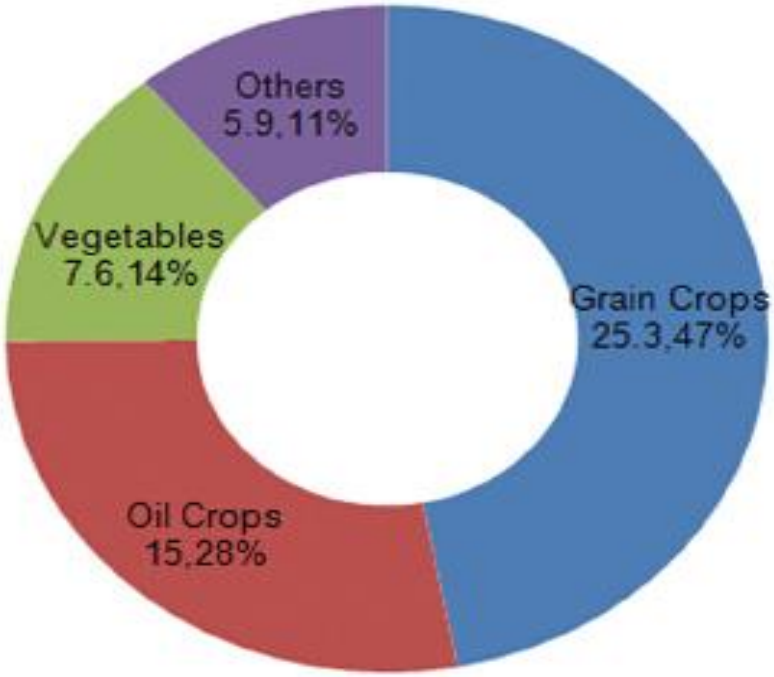
Sumber: ETC Group, 2013

Pasaran Benih Dunia, 2014
USD bil, (%)

Tempat :



Tanaman:



ISF, 2014

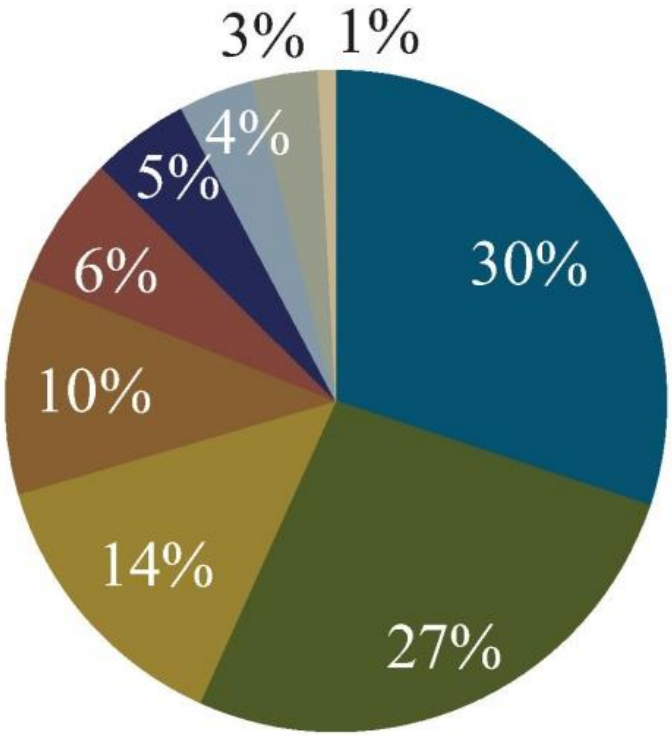
Pasaran Benih Jagung Bijian Dunia

- Nilai pasaran global jagung bijian (2015) –
  - USD 19.44 billion. Pasaran dijangka meningkat tinggi pada 2017-2022.

- Syarikat gergasi bijibenih jagung dunia –
  - Dupont, Dow AgroSciences, Advanta Seeds, Syngenta, Monsanto.

- Negara dengan permintaan tinggi benih jagung bijian - *US, China, Brazil, Argentina, India, Mexico, Indonesia* and *France*.

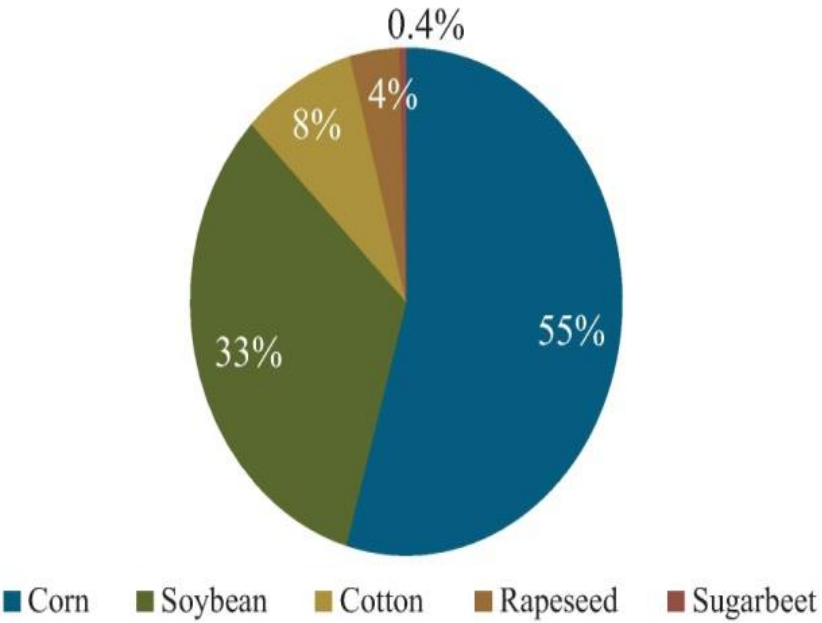
Global Conventional Seed Sales by Crop (2014)



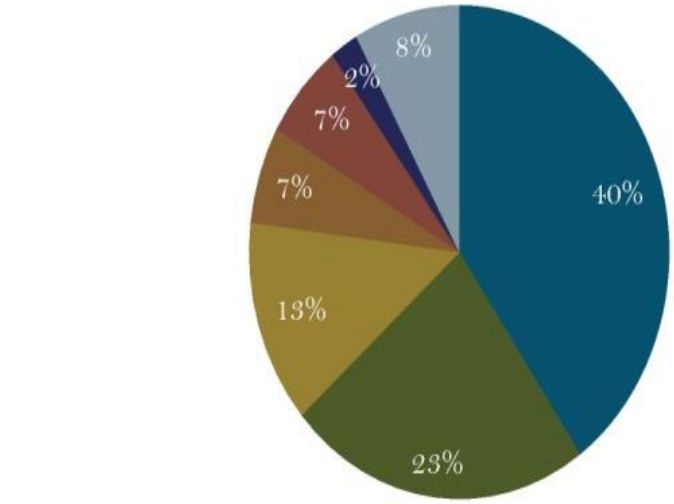
Vegetables
Corn
Cereals
Rice
Soybean
Rapeseed
Sunflower
Sugarbeet
Cotton

Source: Phillips McDougall, report published as of March 2015.

Global Biotech Seed Sales by Crop (2014)



Area of Biotech Crops by Country (2014)



Source: Phillips McDougall, report published as of March 2015.

Kejayaan *Landmark* Pembiakbakaan

- **Memaksimum produktiviti melalui pengeluaran varieti berhasil tinggi**

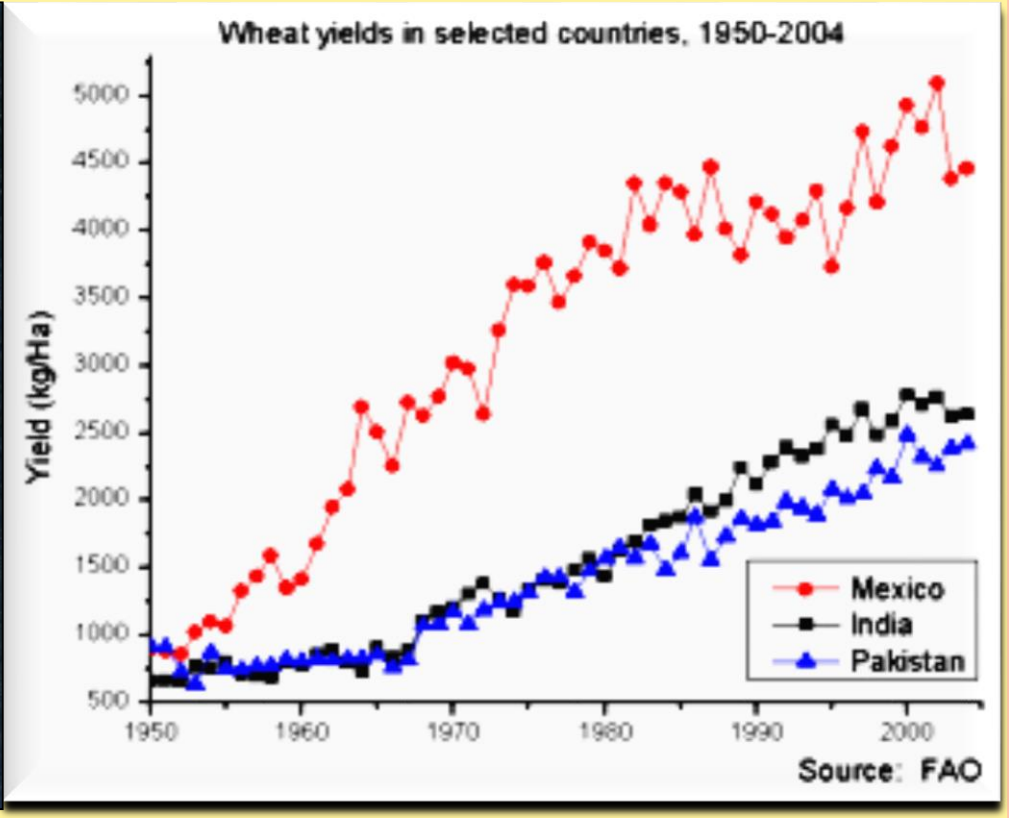
Dr. George Harrison Shull – membangunkan **jagung hibrid pertama** (1909).

Nobel Laureate Sir Dr. Norman Borlaug (‘bapa Revolusi Hijau’) - membangunkan **gandum renek**, yang tinggi hasil, resistan pada penyakit (1950 – 1970)

Prof Dr. Yuan LongPing (‘bapa padi hibrid’) – membangunkan **padi hybrid pertama** (1990an).

The Green Revolution

Normal and dwarf wheat



Green Revolution wheat yields, 1950-2005

- ✓ **Led by Sir Dr. Norman Borlaug, the Nobel Laureate for Agriculture (1970)**
- ✓ **Japanese dwarf wheat (including Norin) and rice varieties with high efficiency in fertiliser utilisation and resistance to stem rust, have helped to elleviate famine and reduce poverty in the Third World countries; Mexico, India and Pakistan.**

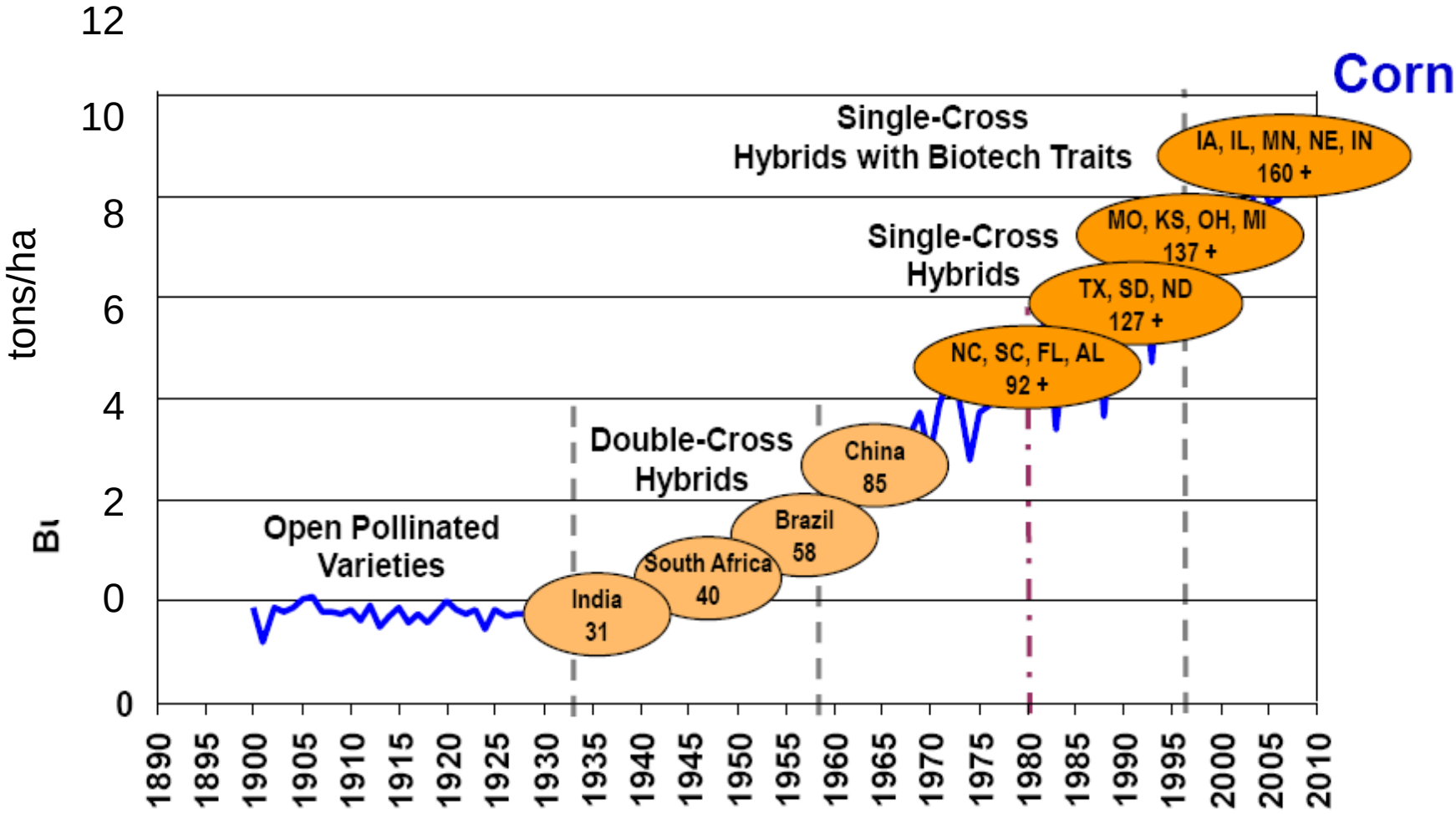
"Waterfall Rice"

- **Prof. Yuan LongPing, 'bapa kepada padi hibrid' membangunkan *"waterfall rice"* dari program *super hybrid rice breeding* di negara China, bermula pada tahun 1996, dengan sasaran hasil 10.5 t/ha.**
- **Bijian padi melimpah dari tangkai padi *"super hybrid rice"*, berpotensi memberi hasil hasil bijian 13.5 t/ha.**

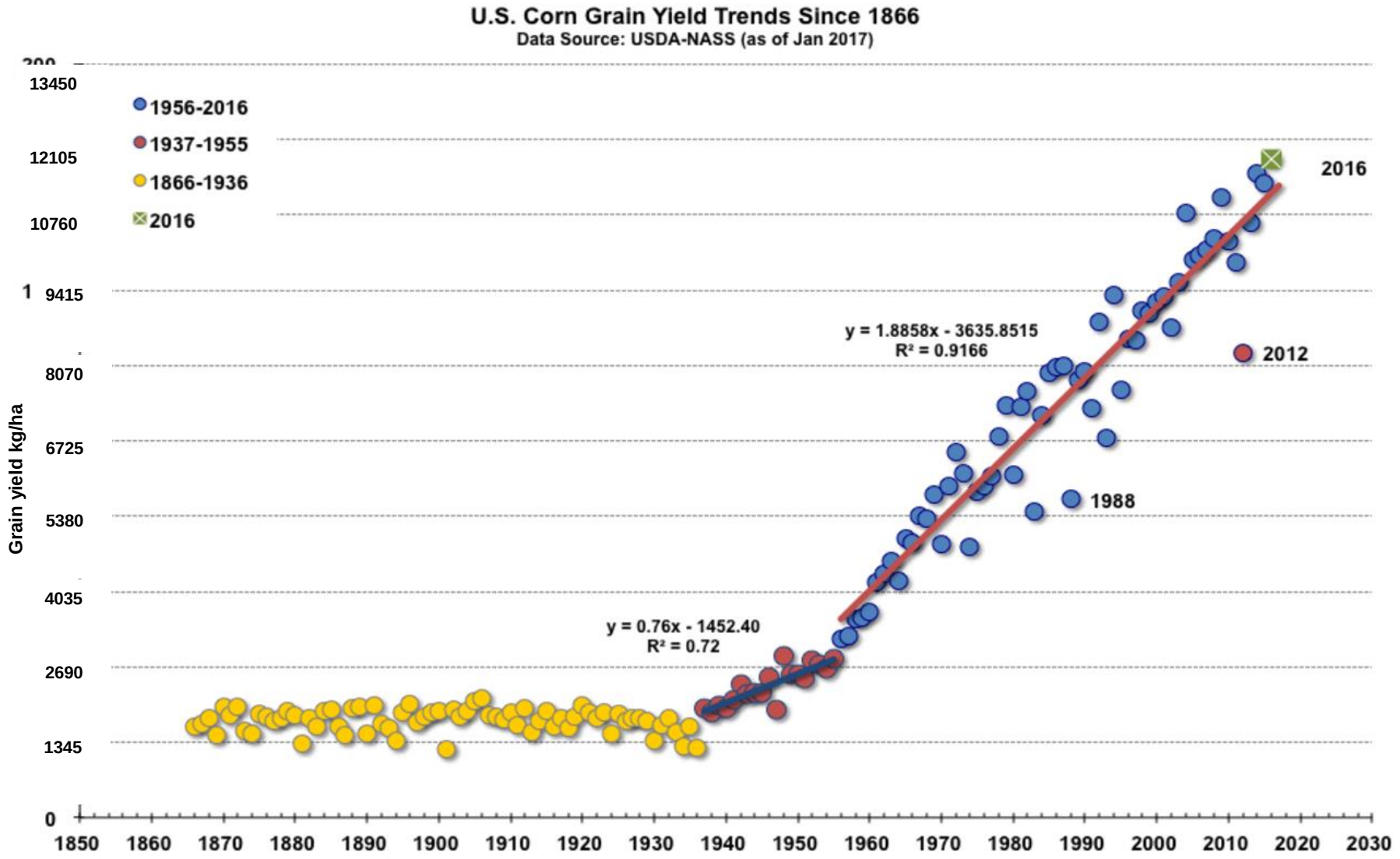
Prof. Yuan LongPing

Waterfall rice

Peningkatan Produktiviti yang Ketara Dicapai Melalui Pembangunan Varieti Unggul Jagung Bijian



Trend Peningkatan Hasil Jagung Bijian di US (1866-2016)

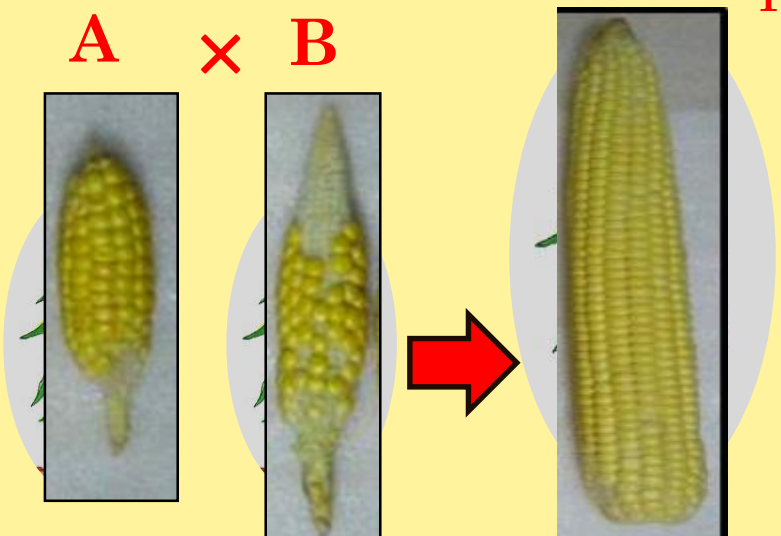


Pembiakbakaan Hibrid Secara Konvensional

Pembentukan Titisan Inbred

Hibrid Kacukan Tunggal:

Inbred A × Inbred B → Hibrid F_1



Heterosis

Inbred A × Inbred B → Hibrid Kacukan Tunggal

Pembiakbakaan Hibrid Melalui Haploid Gandadua (*Dihaploid*) (DH)

SCIENCE FORUM 2013
Nutrition and health outcomes: targets for agricultural research
23–25 September 2013, Bonn, Germany

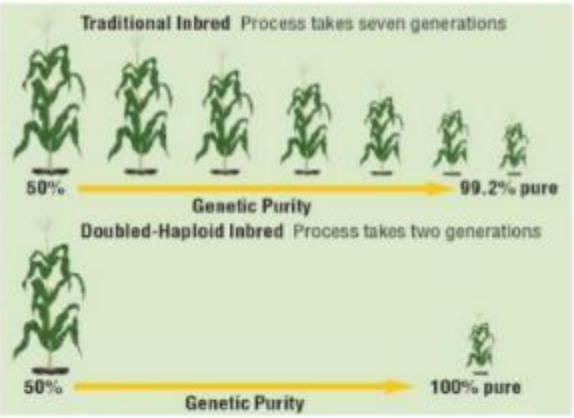
Independent Science and Partnership Council
CGIAR
BMZ

Doubled haploid technology to speed inbred line development

- Rapid development of inbred lines combining:
  - resistance to *A. flavus* and aflatoxin
  - insect and disease resistance
  - drought /heat tolerance
- **DH technology offers**:
  - Faster Inbred Line Production + 100% Pure Inbred Lines + Higher Efficiency Gains
  - 2 generations needed to develop homozygous inbred lines compared to 6 generations using conventional techniques

Conventional vs DH Inbred Line Development

- Produced by repeated generations of selfing
- In each generation, heterozygosity reduces by 50%
- Resulting inbred lines s are highly homozygous but not 100%
- DH technique – a quicker method to obtain 100% pure inbred lines



Generation	S1	S2	S3	S4	S5	S6	S7
Homozygosity (%)	50	75	87.5	93.75	96.875	98.45	99.23
Months	6	12	18	24	30	36	42

Varieti dan Pembiakbakaan Jagung Bijian di Malaysia

- ✓ Metro (dari Indonesia, 1960an-1970an) – OP, 3-4 t/ha

- ✓ Suwan series (hingga Suwan 5)
  (dari Thailand, 1970an - kini) – OP, 4-5 t/ha

- ✓ MARDI Composite 1 (MARDI, 1977) – OP, 3-4 t/ha

- ✓ Putra J-58 (UPM; Saleh, 1998) – hibrid F_1 pertama, 6.2 t/ha

- ✓ Kini… banyak varieti hybrid F_1 terdapat di pasaran – Cargill, Pioneer, Pacific Seeds, CP, Green World Genetics (tempatan) - GWG 888, CGG 111 – hibrid F_1 , 6-10 t/ha

Kajian Komersial

- Kesedaran untuk membangunkan industri jagung bijian negara sejak tahun 1987 (Bengkel Jagung Negara, 1987)
- Pengujian komersial oleh MARDI (1990-1992), Setiawan, Perak
  - Di dua estet, 100 ha, tanpa pengairan, pengujian 3 tahun
  - Penggunaan varieti yang inferior (Suwan)
  - Hasil bijian 1.31 to 4.6 ton/ha
  - *Economic break even yield* – 4-5 ton/ha
  - Harga import – RM450.00/ton
    - (Zahari and Wong, 2009)
- Pengujian penanaman komersial oleh Leong Hup di Mersing, Johor (1999-2000)

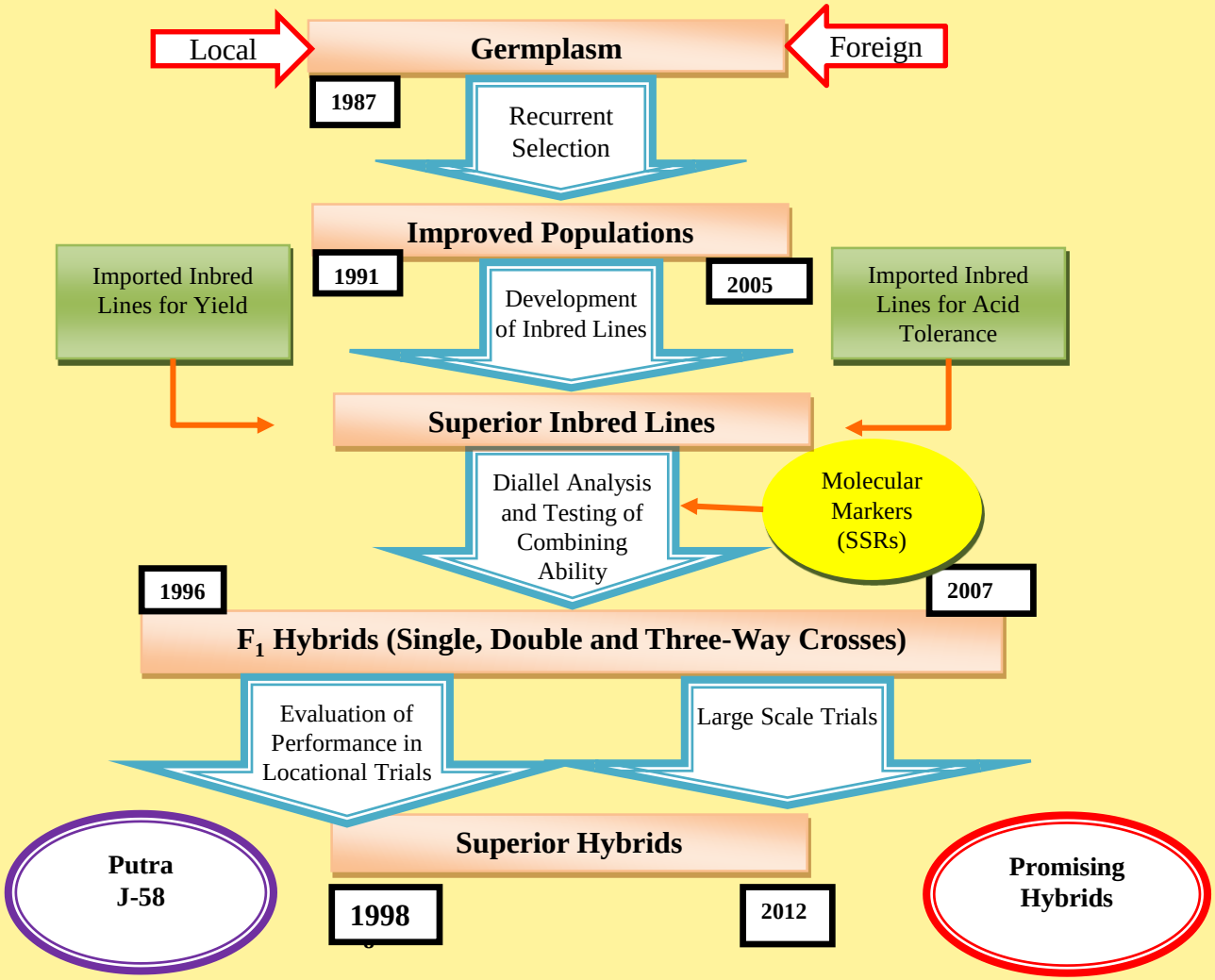
➢ Dari kedua-dua pengujian, dirumuskan penanaman jagung bijian di Malaysia tidak menguntungkan

⇨ kerajaan hilang minat memajukan industri jagung bijian

Program Pembiakbakaan Jagung Bijian di Universiti Putra Malaysia

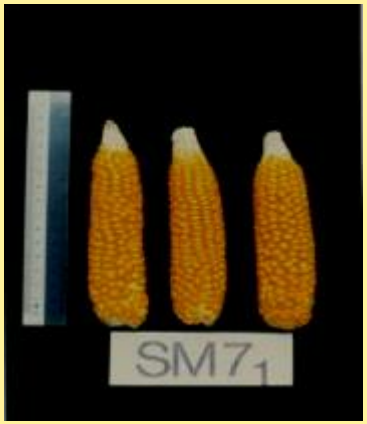
(1987- 2017)

Pembiakbakaan Jagung Bijian di Universiti Putra Malaysia (1987- 2017)



Pembangunan Hibrid untuk Hasil dan Kualiti

✓Pembentukan titisan inbred dari pelbagai latarbelakang : Improved Suwan and Improved Metro, dan kemudiannya varieti-varieti dari Philippines, populasi SMC317, SMC305 dan TW.



Titisan inbred terpilih digunakan dalam kacukan diallel (Sujiprihati *et al.*, 2001)

Inbred line	Country of source population	Grain weight per plant (g)	Days to tasselling (days)	Days to silking (days)
UPM-TW-12	Philippines	36.8	52.3	57.9
UPM-TW-5	Philippines	43.5	56.8	61.0
UPM-SM5-9	Philippines	34.7	57.2	57.9
UPM-SM5-5	Philippines	43.9	56.3	61.3
UPM-SM5-4	Philippines	44.9	57.9	63.6
UPM-SM7-6	Philippines	82.6	58.1	60.1
UPM-SM7-10	Philippines	33.1	57.8	62.5
UPM-SM7-11	Philippines	45.3	56.1	60.1
UPM-SW-2	Thailand	35.8	58.9	59.6
UPM-SW-9	Thailand	29.4	60.1	63.0
UPM-MT-13	Indonesia	39.7	56.2	59.4
UPM-MT-5	Indonesia	54.8	55.8	59.9


Hy 60
2 6 86.


Hy 58
2 6 86.

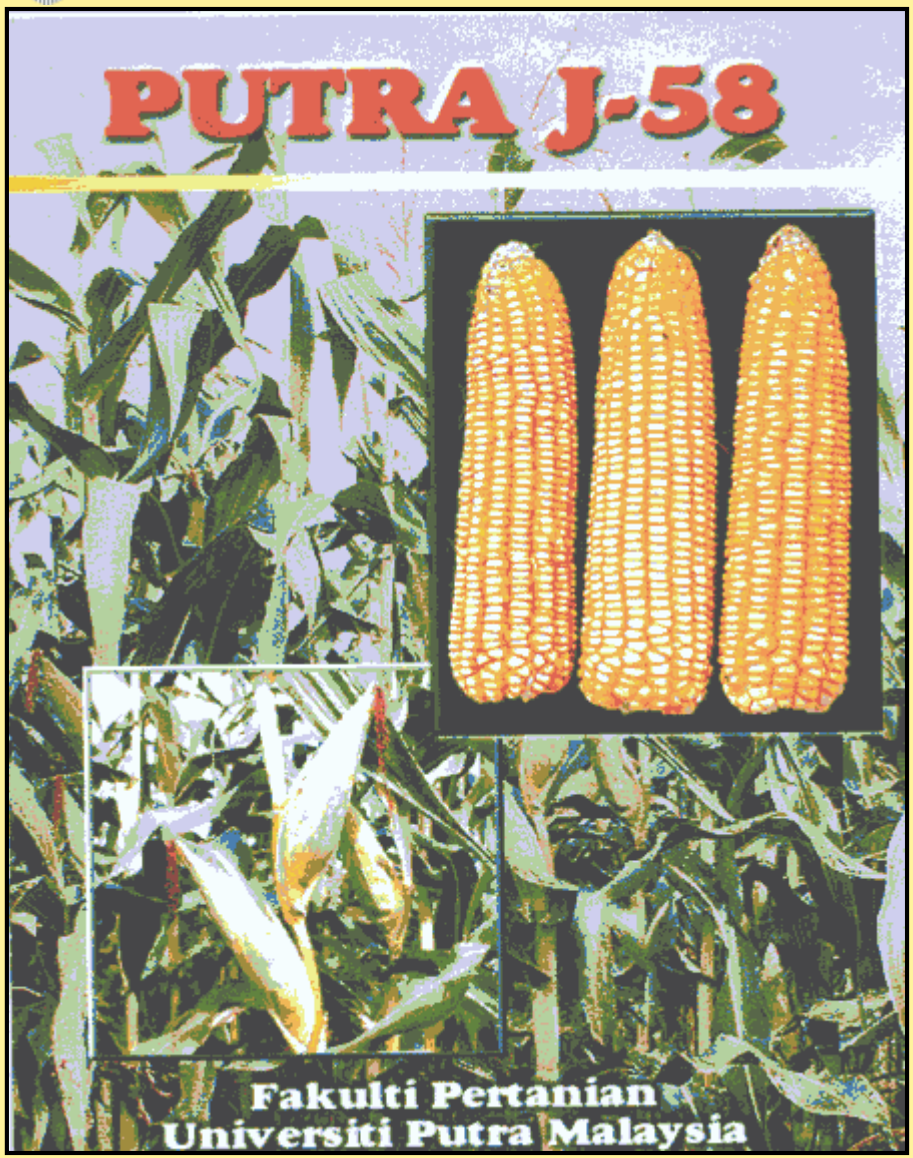

Hy 59
2 6 86.


DC 26
2 6 86.


Hy 20
2 6 86.

Prestasi hibrid terpilih jagung bijian dari kacukan dialel (Saleh *et al.*, 2002b)

Hybrid/ check variety	Grain yield (kg/ha)	Plant height (cm)	Days to tasselling (days)	Days to maturity (days)
Hybrid:				
UPM-SM5-9 X UPM-TW-5 (Hy-17)	5015	169.0	49.0	91.7
UPM-SM5-5 X UPM-TW-12 (Hy-18)	5185	170.6	50.7	92.7
UPM-SW5-4 X UPM-TW-12 (Hy-19)	5096	178.2	50.7	91.7
UPM-SW-2 X UPM-TW-5 (Hy-33)	4963	183.5	48.0	90.7
UPM-SW-9 X UPM-SM5-9 (Hy-43)	5296	184.8	51.0	91.0
UPM-MT-5 X UPM-SM5-9 (Hy-45)	5511	173.2	50.0	88.3
UPM-MT-5 X UPM-SM5-5 (Hy-53)	5259	194.0	52.0	90.0
UPM-SW-9 X UPM-SM5-4 (Hy-58)	5659	164.4	48.0	86.7
UPM-MT-13 X UPM-SM5-4 (Hy-59)	5726	182.4	51.0	88.7
UPM-MT-5 X UPM-SM5-4 (Hy-60)	5948	183.7	51.0	89.0
Check variety:				
Suwan 1	5430	206.6	52.0	89.7
Suwan 3	4474	172.6	52.3	91.3



Yield and Agronomic Characteristics

From plantings in Peninsula Malaysia, average yield and other agronomic characteristics measured from the variety are as follows:

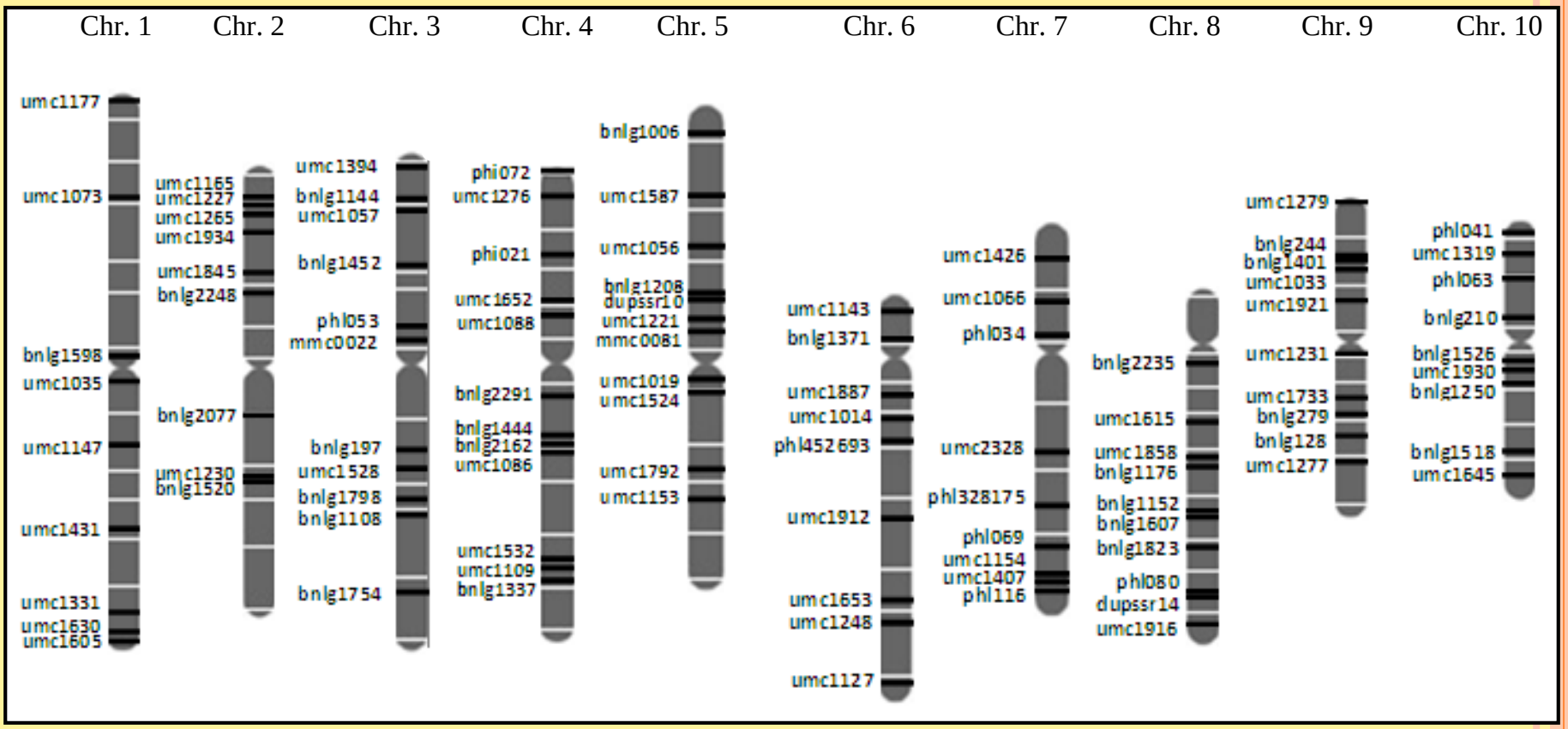
Grain yield (kg/ha):	6220
Shelling percentage (%):	83.4
Plant height (cm):	185
Ear height (cm):	95
Tasseling (days):	49
Maturity (days):	89
Ear weight (g):	144
Ear length (mm):	165
Ear diameter (mm):	46.6
100-seed weight (g):	27.8

Nutritive value in grains

Average value for important nutritive composition in the grains are as follows:

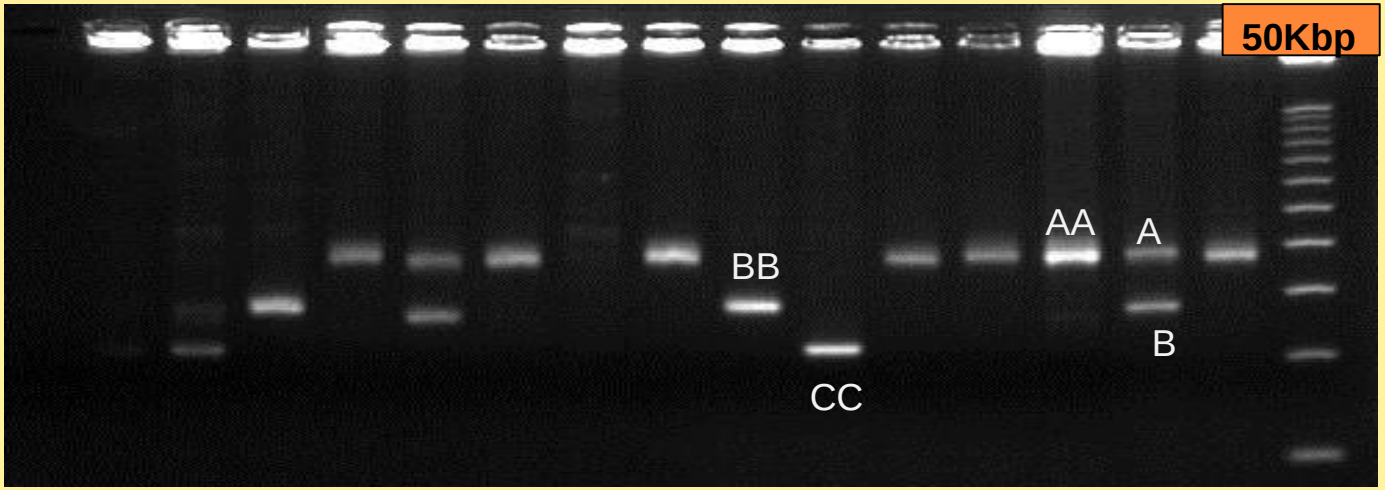
Dry matter (%):	88.2
Crude protein (%):	9.2
Oil (%):	4.9
Crude fibre (%):	2.3
Ash (%):	1.8
Gross energy (kcal/kg):	4328
Starch (%):	65.5
Sugar (%):	1.85

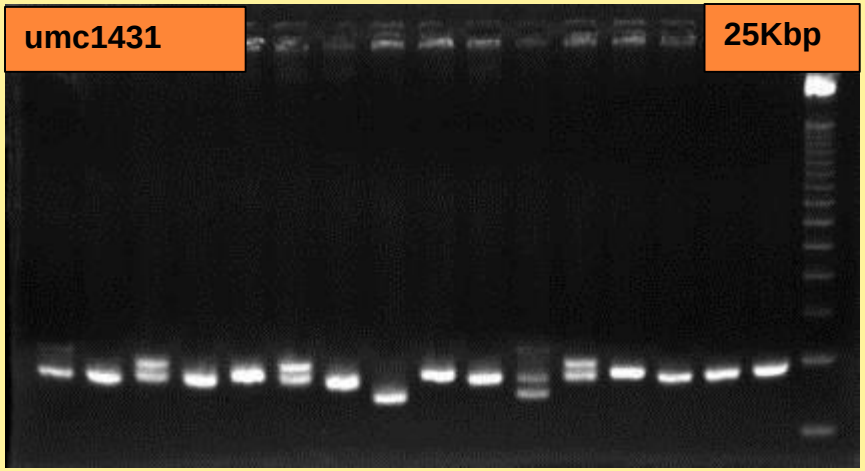
Penggunaan Penanda DNA Microsatellite

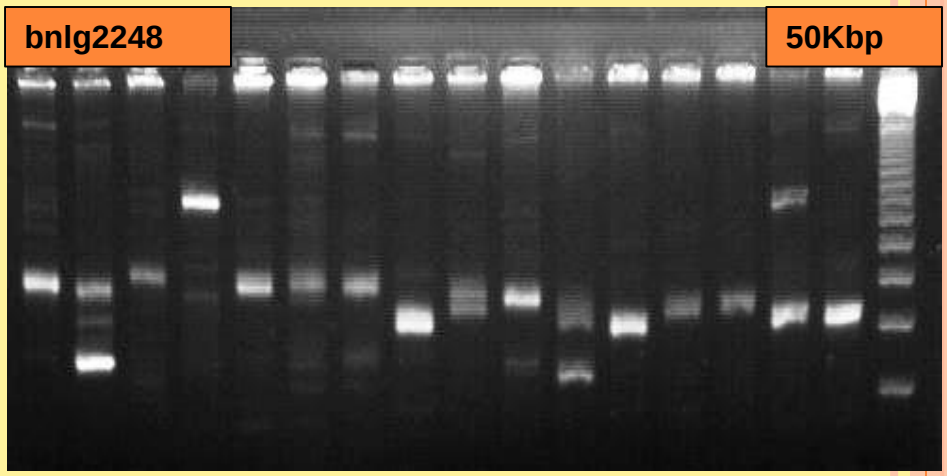


Sumber: Maize GDB, 2009

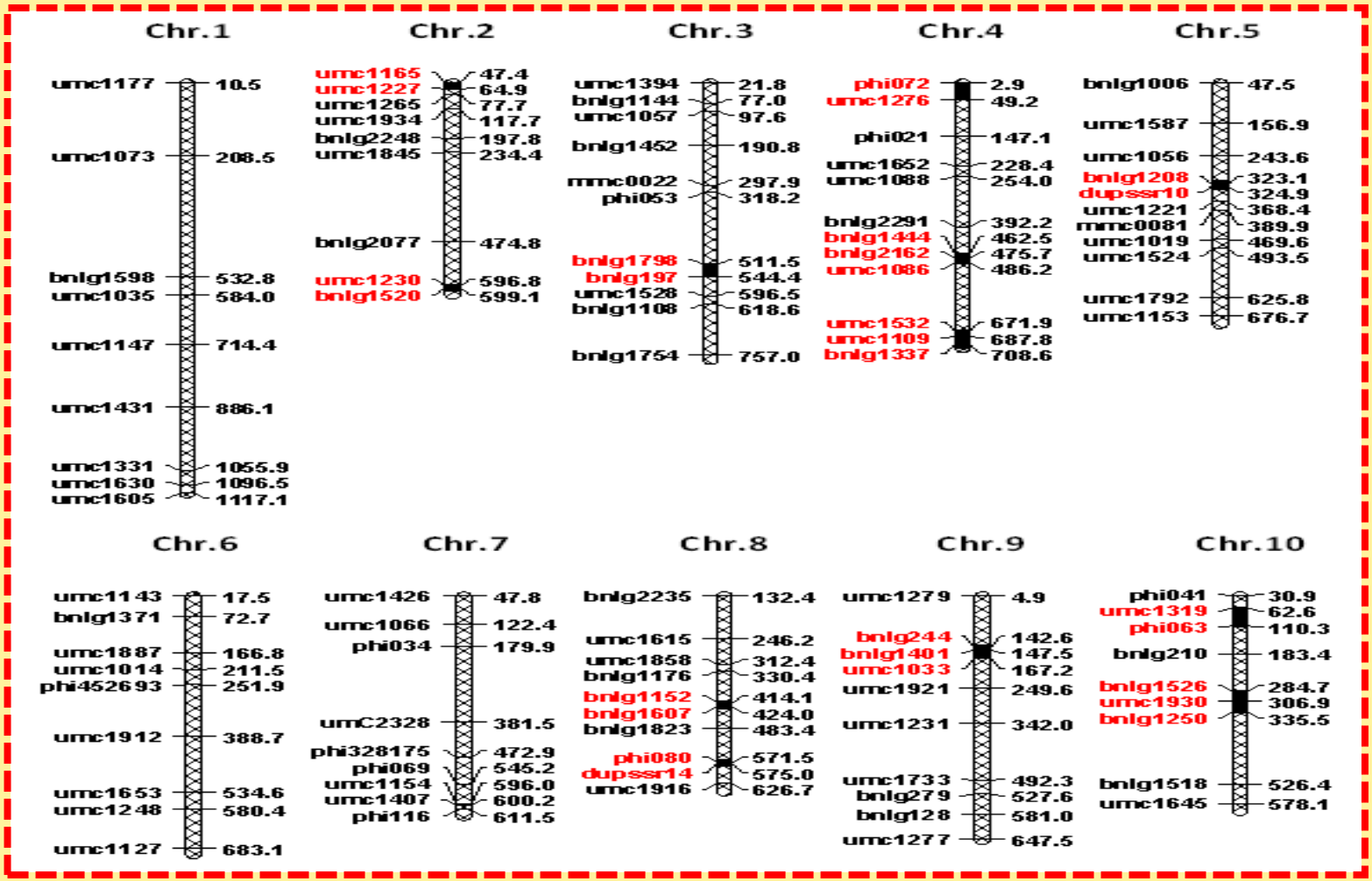
Skor Jalur DNA yang Diamplifikasi







Penggunaan penanda molikul dan pengenalpastian lokasi Lokus Ciri Kuantitatif (QTL)



Sumber: Kashiani et al., 2012

Calon Lokus untuk QTL

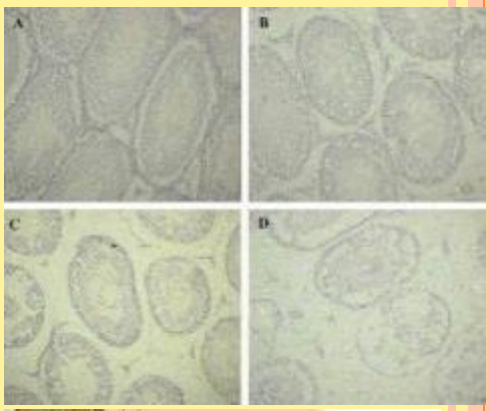
[Locus Allele] - [Locus Allele]	Bin	Trait
[bnlg1798 F] - [bnlg197 D]	3.02 -3.05	Cob Length
[bnlg2162 A] - [bnlg1444 A]	4.06- 4.08	Yield
[bnlg2162 A] - [umc1086 A]	4.06- 4.08	Yield
[bnlg2162 A] - [umc1532 A]	4.06-4.10	Plant Height
[bnlg1444 A] - [umc1086 A]	4.08-4.08	Cob Length
[bnlg1444 A] - [umc1532 A]	4.08-4.10	Cob Length
[bnlg2162 C] - [umc1086 B]	4.08-4.08	Yield
[bnlg2162 C] - [umc1109 B]	4.08-4.10	Ear Height
[umc1086 B] - [umc1109 B]	4.08-4.10	Plant Height
[umc1086 A] - [umc1532 A]	4.08-4.10	TSS
[bnlg1208 C] - [dupssr10 C]	5.04-5.04	Cob Diameter
[bnlg1208C] - [umc1221 D]	5.04-5.04	Ear Weight
[bnlg1208 C] - [mmc0081 C]	5.04-5.05	Ear Height
[dupssr10 C] - [umc1221 D]	5.04-5.04	Cob Diameter
[dupssr10 C] - [bnlg1208 C]	5.04-5.05	Cob Diameter
[dupssr10 G] - [mmc0081 F]	5.04-5.05	Cob Diameter
[dupssr10 D] - [mmc0081 C]	5.04-5.04	Yield

Pembangunan Hibrid Untuk Ketahanan di Tanah Berasid

- ✓ **72% tanah produktif di Malaysia adalah berasid dan terluluhawa**
- ✓ **Produktiviti rendah**
- ✓ **Kos pengapuran untuk menaikkan pH adalah tinggi**

Pembiakbakaan Hibrid Jagung Bijian untuk Ketahanan di Tanah Berasid

- ✓ Menyaring induk-induk titisan inbred yang dibentuk di UPM dan juga yang diimport untuk ketahanan melalui :
  - *Hematoxylin staining assay*
  - Larutan nutrien
  - Ujian dalam Rumah Kaca
  - Ujian di Ladang



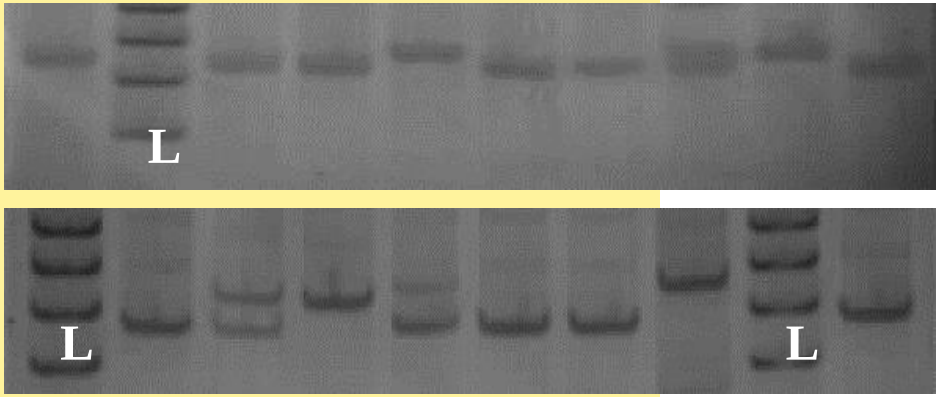
Pemilihan Titisan Inbred Untuk Ketahanan di Tanah Berasid

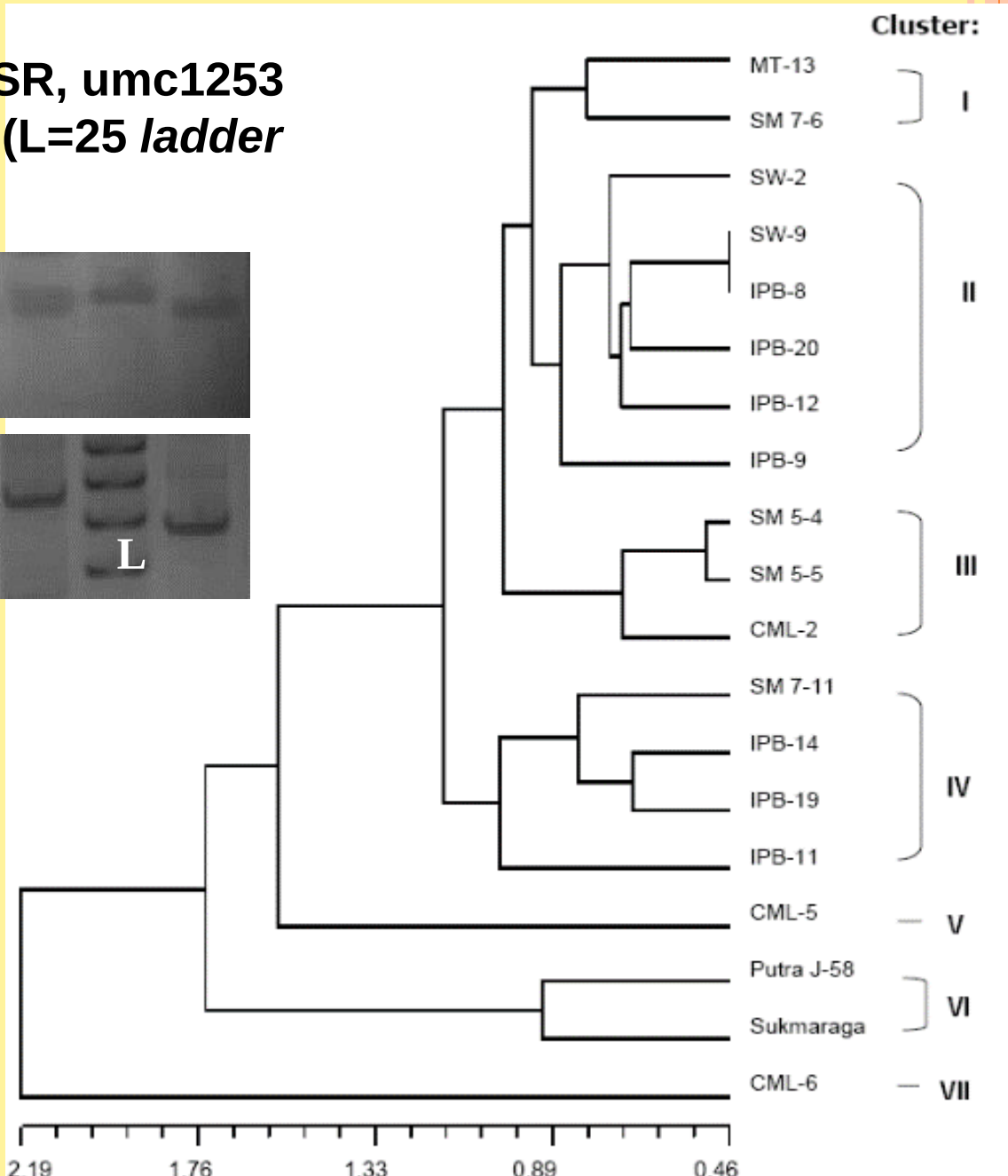
Inbred line	Grain yield		Ear height		Days to silking		Source population
	Acid soil ($kgha^{-1}$)	Relative* (%)	Acid soil (cm)	Relative* (%)	Acid soil (days)	Relative* (%)	
MT-13	869	55	33.1	66	56	76	Metro, Indonesia
SM 5-4	767	43	22.5	59	62	76	SMC 305, Philippines
SM 7-11	901	55	30.4	61	58	66	SMC 317, Philippines
SW-2	661	41	30.8	62	59	71	Suwan 1, Thailand
CML-2	567	46	15.6	53	62	74	CIMMYT Line
CML-6	60	18	21.3	64	72	82	CIMMYT Line
IPB-12	915	49	26.2	63	59	73	IPB Line, Indonesia
IPB-14	681	48	27.6	72	58	72	IPB Line, Indonesia
IPB-20	479	36	23.0	60	59	74	IPB Line, Indonesia

- **Prestasi relatif yang ditunjukkan sebagai peratus prestasi di tanah tidak berasid (dikapur)**

Penggunaan Penanda Molikul

Hasil PCR dari penanda SSR, umc1253 (atas) dan phi034 (bawah) (L=25 *ladder* pasangan bes)





10 Hibrid Terbaik Untuk Ketahanan Pada Tanah Berasid (pH<5.0)

Hybrid		Grain yield ($kgha^{-1}$)	Hybrid		Grain yield ($kgha^{-1}$)
Unlimed soil			**Limed soil**		
In Serdang					
H24	IPB-14 X MT-13	4317	H8	IPB-20 X CML-6	7426
H9	SM 5-4 X SM 7-11	4092	**H36**	CML-2 X CML-6	7413
H25	IPB-14 X CML-2	3988	H34	MT-13 X CML-2	7398
H4	IPB-20 X IPB-12	3910	H26	IPB-14 X CML-6	7224
H28	IPB-12 X MT-13	3765	**H21**	SM 7-11 X CML-6	7212
H29	**IPB-12 X CML-2**	**3746**	**H25**	IPB-14 X CML-2	6775
H23	IPB-14 X SW-2	3742	H35	MT-13 X CML-6	6684
H31	SW-2 X MT-13	3739	H9	SM 5-4 X SM 7-11	6662
H3	IPB-20 X IPB-14	3733	**H10**	SM 5-4 X IPB-14	6431
H11	SM 5-4 X IPB-12	3680	**H29**	**IPB-12 X CML-2**	**6334**
Putra J-58		3451	Putra J-58		6280
Sukmaraga		4135	Sukmaraga		6143
Hybrid mean		3350			6052
Al Exchangeable ($cmol_c kg^{-1}$)		1.58			0.52
Soil pH		4.6			5.2

Pelajar Siswazah di Selia dalam Pembiakbakaan Jagung Bijian

PhD:

- Sriani Sujiprihati. Heterosis, combining ability and yield prediction in hybrids from local maize inbred lines (1992-96)
- Than Da Min. Stability analyses on performance of selected grain maize genotypes (1999-2004)
- Dewi Hayati, P.K. Genetics and development of maize hybrids tolerant to acidic soils. (2004-2010)
- Hassan Mokhtarpour. Evaluation of DSSAT Model and the Development of A New Growth and Yield Maize Model. (2007–2011)

Pelajar Siswazah di Selia dalam Pembiakbakaan Jagung Bijian

MASTER OF SCIENCE / MASTER OF AGRICULTURE SCIENCE:

- Kamaruhzaman Mat Zin. Reciprocal recurrent selection on grain corn varieties Suwan and Metro (1991-92)
- Abdullah Daud. Heterosis, heritability and effects of location on selected grain maize hybrids (1994-96)
- Mohd. Noor Ibrahim. Effects of two cycles of reciprocal recurrent selection on two grain corn varieties (1993-1997)
- Abdul Wahab Mustan. Identification of heterotic groups among maize inbred lines using RAPD molecular marker (1997-1998).
- Khayamuddin Panjaitan. Combining ability and heterosis from diallel crosses in grain maize (1999-2003)
- Mohd. Asraf Kamaluddin. Studies on G X E interaction in grain maize of tolerance to acid soils in maize inbred lines. (2002-2003)
- Nguyen Thi Mai Anh. Establishment of in-vitro culture for maize (*Zea mays* L) inbred lines SM5-4 for *Agrobacterium* mediated transformation (2002-2005)

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- Min, T. D. and **G. B. Saleh.** 2003. Phenotypic stability of selected tropical maize genotypes at four locations. *Asian J. Plant Sciences* 2(10): 743-747.
- Min, T.D., **G.B. Saleh,** R.A. Halim, A.R. Anuar and K. Panjaitan. 2004. Genotype by environment interaction and stability of maize genotypes for grain yield, maturity and harvest index. *Malays. Applied Biology* 33(2):1-6.
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Cabaran dalam Pembiakbakaan Jagung Bijian

- ✓ Dasar negara yang tidak konsisten
- ✓ Kurang bilangan pembiakbaka terlatih
- ✓ Tiada sokongan dana jangka panjang

Penggunaan Varieti Hibrid Jagung Bijian Di Negara Serantau

Thailand

PACIFIC SEEDS PTY LTD
Modern science - traditional values

Varieti	Potensi Hasil (kg/ha)
PAC 224	10,775 (Max. 13,209)
PAC 339	11,408 (Max. 13,926)
PAC 313	10,032 (Max. 12,159)
PAC 999 SUPER	10,121 (Max. 13,008)
PAC 105 (999)	10, 532 (Max. 12,847)

Thailand

syngenta Thailand

Varieti	Potensi Hasil (kg/ha)
NK 48 (high yield drought tolerant)	9,375 – 12,500
NK 58	8,125 – 9,375
S6248 (high yield, drought resistant)	8,750 – 11,875
S7 328	10,000 – 13,125

Thailand

Varieti	Potensi Hasil (kg/ha)
CP 888	8,000-12,500
CP 999	8,100 – 10,800
CP 818	8,960 – 11,865
CP 9988	9,000 – 12,125

Thailand

Varieti	Potensi Hasil (kg/ha)
Pioneer B 80	9,000 – 11,000
Pioneer T 60	8,500 – 13,312.5
Pioneer 46	8,500 – 13,312.5
Pioneer 11	7,312.5 – 9,500
Pioneer 54	8,375 – 12,322.5
Pioneer 72	8,125 – 13,000

Indonesia

Syarikat	Varieti	Hasil Bijian (T/ha)
BISI International Tbk	BISI-2	8.5 -13.0
	BISI-12	±12.4
	BISI-16	9.2 – 13.4
	BISI-18	±12.0
	BISI-222	10.4 – 13.7
	BISI-816	10.4 – 13.7
Sang Hyang Seri	SHS-3	10.9 - 12.3
	SHS-4	10.9 – 15.5
	SHS-11	9.0 – 12.0
	SHS-12	8.5 – 12.0
DuPont (Pioneer)	P21- Dahsyat	±13.3
	P27- Gajah	±11.0
	P29- Harimau	±11.0
	P32- Singa	±13.4
	P35- Banteng	±12.1
Syngenta	NK Perkasa	9.7 – 13.3
	NK7328	±12.4
	NK212	±12.0
	NK22	8.7 – 10.48
Monsanto	DEKALB 77	12.6
	DEKALB 85	11.9
	DEKALB 95	10.6
	DEKALB 888	12.9
	DEKALB 999	-


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BISI

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Jagung Hibrida
PERTIWI 2

BENIH
PERTIWI®

Benihnya
Petani Indonesia

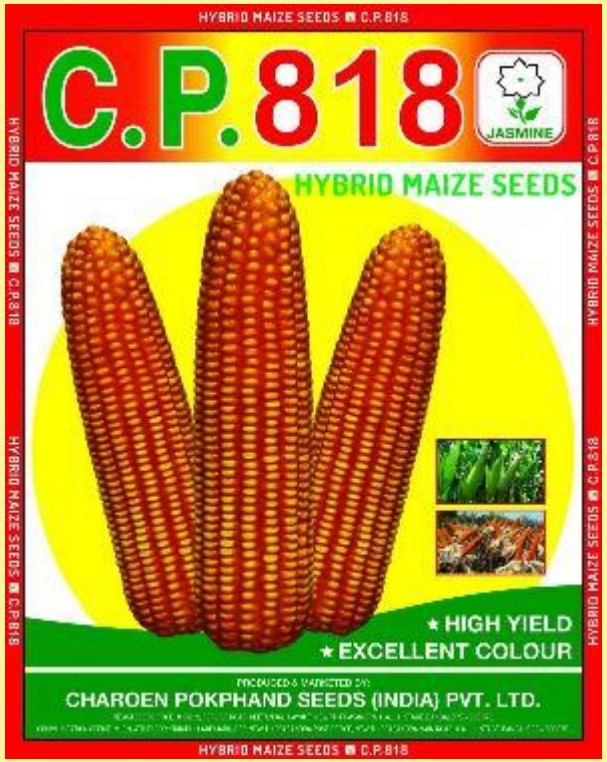
Jagung Hibrida
PERTIWI 3

Philippines

	Syarikat	Varieti	Hasil Bijian (T/ha)
	Pioneer	P3774	±14.0
		P3645	±14.0
		P4097	±14.0
		P4124	±13.0
		P2895	±13.0
	Monsanto	DEKALB 6919S	12.4
		DEKALB 6818S	12.2
		DEKALB 9132S	11.9
		DEKALB 6999S	13.7
		DEKALB 7898S	11.8
		DEKALB 6818S	12.5
		DEKALB 9898S	11.8
	BIOSEED	Elite BIO 9541	12.0
		EliteHealer 101	11.0
		Elite BIO 9744	-
		Elite BIO 9909	11.0
		Elite BIO 9698	-
	Syngenta	NK8840	10.0 – 14.0
		NK5447	10.3
		NK6614	8.0
		NK8850	7.57
		NK6204	7.9
		NK6630	-
		NK6208	-

India

C.P.S. INDIA



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Inisiatif Kerajaan Terbaik

Varieti Tempatan – GWG 888, GWG 111

Potensi Hasil- 10 t/ha

Ciri-ciri Varieti Hibrid Jagung Bijian Yang Unggul Untuk Malaysia

- ✓ Hasil bijian yang tinggi (hasil > 10 t/ha). Dan stabil.
- ✓ Kualiti pemakanan yang tinggi.
- ✓ Berupaya mengadaptasi kepada persekitaran yang berbeza (environmental stability).
- ✓ Tahan kepada tanah berasid.
- ✓ Tahan keadaan kekeringan.
- ✓ Tahan keadaan terendam.
- ✓ Tahan kepada penyakit dan perosak.
- ✓ Sesuai untuk aplikasi mekanisasi di ladang, proses pengeringan dan pengilangan.

Halatuju untuk Malaysia

- **Jangka Pendek - menguji dan memilih sebanyak mungkin varieti unggul komersial dari luar dan dalam negara untuk diadaptasi.**
  - **Untuk mengurangkan risiko kegagalan penanaman, perlu pelbagaikan jenis/varieti yang ditanam (GXE Interaction).**
- **Jangka Sederhana – Menguji prestasi sebanyak mungkin varieti hibrid berpotensi (breeders' seeds) dalam negara penanaman di skala besar.**
- **Jangka Panjang - memberikan sokongan dana untuk program pembiakbakaan tempatan agar usaha menghasilkan variety hibrid unggul untuk persekitaran Malaysia dapat dijadikan realiti.**

Kesimpulan

- Kejayaan dalam pembiakbakaan dan pembaikan genetik jagung bijian di dunia telah memberi impak yang sangat tinggi kepada sekuriti makanan.

- Dalam situasi perubahan cuaca, kesediaadaan makanan dan ekonomi, Malaysia perlu komitmen pada dasar pengeluaran jagung bijian tempatan, bagi menggalakkan usaha pembiakbakaan bagi menghasilkan varieti tempatan yang sesuai.

- Pembangunan varieti baru perlu dilaksanakan melalui pembiakbakaan dengan pendekatan konvensional dan bioteknologi.

- Industri pengeluaran benih jagung tempatan berpotensi menjadi industri yang sangat maju di negara ini. Perlu sokongan kerajaan untuk maju.

Terima Kasih

Agriculture is Life