



DEVELOPMENT OF HIGH YIELDING PLANTING MATERIALS AND UNIQUE FLAVOUR COCOA BEANS IN MALAYSIA

HAYA RAMBA, TEE Y. K, NURAZIAWATI, M.Y, ALBERT LING S.C, ROSMIN. K & BONEY, M.

MALAYSIAN COCOA BOARD, KOTA KINABALU SABAH MALAYSIA

EMAIL: hayaramba@koko.gov.my / hayaramba@yahoo.com

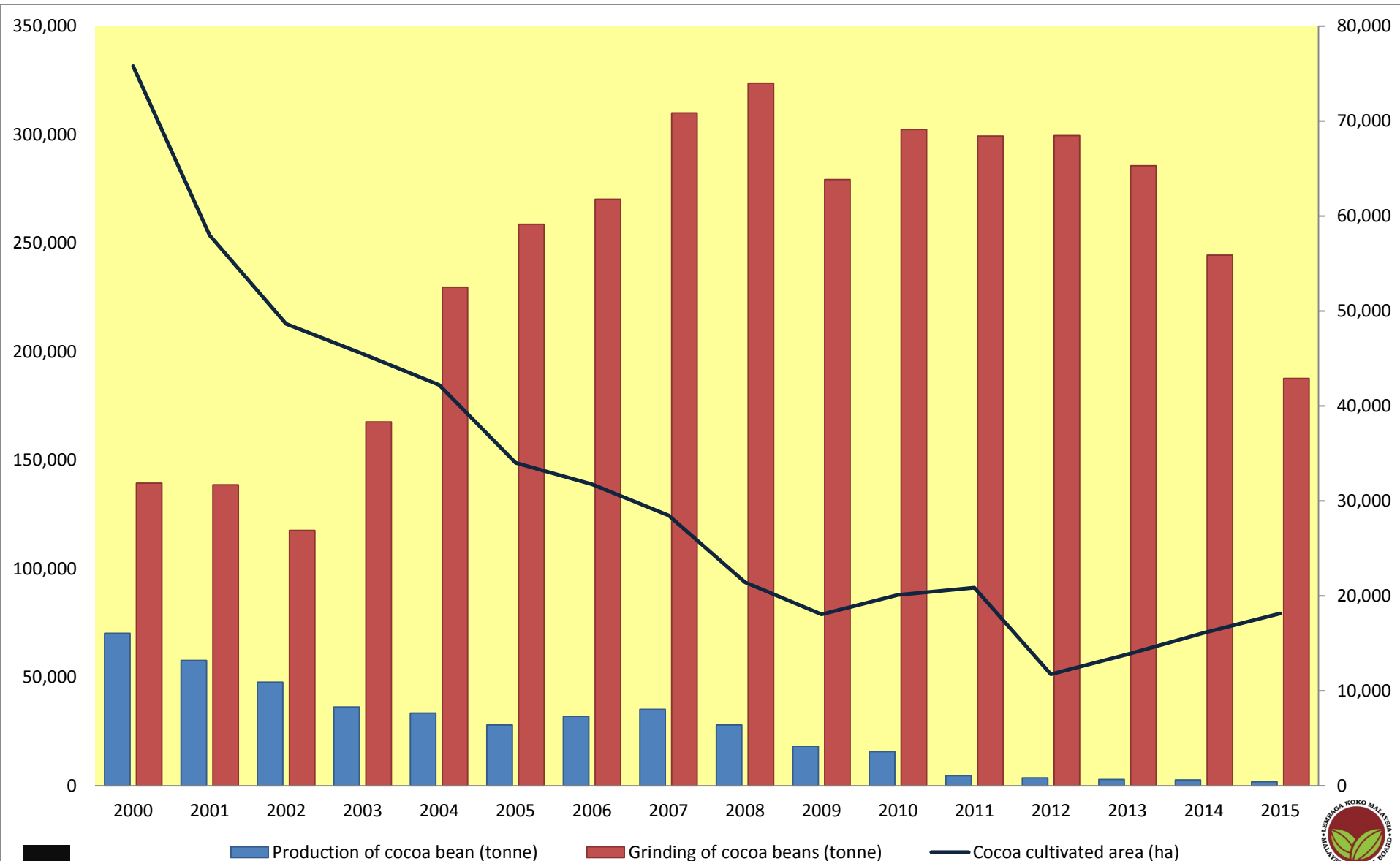


Introduction

Cocoa, first planted in Malaysia (1778), was seriously studied in 1940s, anticipated for 100,000 ton production as a crop (Cheeseman, 1947); expanded very rapidly 1970s; 420,300 ha producing >247,000 tons of dry beans in 1990, Malaysia then was the 3rd largest producer in the world after Cote d'Ivoire and Ghana.

This rapid rise: due to extremely good world cocoa prices, the public urge and need for a good cash crop. Such life-short achievements brought about inherent use of poor planting materials, low and un-skill management and poor technology utilization and bean production of inferior quality that be set the upstream industry.

Scenario of Cocoa Planting Hectarage, Bean Production and Grinding in Malaysia



History of Planting Materials in Malaysia

- 1950's-1960's**

Amelonado and its hybrids, but, were unsuitable to the local environment because of susceptibility to dieback disease and poor tolerance to expose (high light intensity); poor yielder (e.g. Aml x Pa7, Aml x SCA9)

Table 2.1 Yield and bean characteristics of some recommended hybrids

Hybrid	Dry Bean Yield (kg/ha/year)	Pod Value	Average Bean Weight (g)	Bean Number Per Pod
UIT 1 X NA 33	2254	21.4	1.20	39
UIT 1 X SCA 6	2494	26.6	1.01	39
UIT 1 X SCA 12	2328	25.8	1.11	37
IMC 67 X SCA 9	1416	24.2	1.00	43
PA 156 X IMC 67	1704	23.1	1.12	41
PA 138 X SCA 9	1707	26.3	0.99	42
PA 138 X SCA 9	1688	25.8	1.01	40
PA 173 X SCA 9	1521	27.9	1.01	36

Source:
1. Phoa, P. K. (1982). A review of twenty-five years of Cocoa Breeding at the Cocoa Research Station, Quoin Hill. *Seminar Penyelidikan Kaka untuk Peningkatan Pertanian Negara, Sesiyen Penyelidikan Kaka, Rukut Quoin Tawau, Sabah*.
2. Yapp, H. H. and Phoa, P. K. (1987). Inter-Upper Amazon Cocoa Hybrids of Sabah. Series III Progeny Trial. *SAS Seminar, Palm Kernel Utilization and Recent Advances in Cocoa Cultivation*, 11-13 June, 1987, Tawau Sabah.



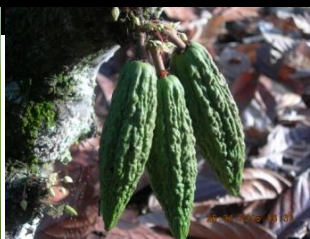
- 1970's-1990's**

Trinitario and Forestero hybrids of the Upper Amazon origin; higher yielding and more tolerant to dieback disease than the Amelonado hybrids (e.g. UIT1 x Na33, UIT1 x SCA6, Pa138 x SCA9, Pa156 x IMC 67)



- 2000's onwards**

Locally selected superior clones; more superior with regards to yield and generally to disease i.e. vascular streak die-back and black pods (e.g. PBC 123, KKM 22, QH 1003, MCBC1)



SELECTION CRITERIA

- Selection of large bean size with weight $\geq 1.0\text{g}$
- Trees selected with high no. of pods $\geq 75/\text{yr}$.
- Number of beans per pod preferably more than 35.
- Shell content of around 10% and lower.
- Trees that yield early & consistent high production
- Trees - shaped and architecture for easy work:- up-right, easy access for harvesting pods without jeopardising production.
- Selection for resistance to pests and diseases.
- Health related chemicals are emphasised such as procyanidins, cyanidins of polyphenols are sought for.
- Butterfat and powder composition/ratios related to industry needs, consumer demands and
- Affected economically: crucial prevailing prices.

Dissemination of Clones with P&D Resistance to the Farmers



Cocoa Pod Borer
Conophomorpha cramerella



**Vascular
Streak
Dieback
(VSD)**



**Black
Pod
Disease**



Summary of Sabah Mixed Hybrids of cocoa released for planting

PERIOD COCOA RELEASED	SABAH MIXED HYBRIDS	ANNUAL DRY BEAN YIELD (kg/ha)						MEAN
		1984	1985	1986	1987	1988	1989	
Series I 1960s	AML X PA7	2056	3539	2643	3268	3007	3513	3004.3
	PA7 X NA32	2659	3588	2532	2993	3025	3507	3050.7
	UIT2 X PA7	2603	4046	2434	3106	2939	3031	3026.5
	UIT1 X NA33	2493	2904	1896	2463	2486	2555	2466.2
	UIT1 X NA32	2091	2750	1739	2454	2112	1975	2186.8
	MEAN	2380.4	3365.4	2248.8	2856.8	2713.8	2916.2	2746.9
Series II 1970s	UIT2 X SCA6	1794	2841	2890	3862	3126	4519	3172.0
	UIT1 X SCA6	1799	2547	2060	4004	3633	3648	2948.5
	UIT2 X SCA12	2019	2532	2416	3935	3488	3734	3020.7
	UIT1 X SCA12	1579	2406	2449	3722	3451	3752	2893.2
	MEAN	1797.8	2581.5	2453.8	3880.8	3424.5	3913.3	3008.6
Series III 1980s	PA156 X SCA9	753	1159	1622	2808	3007	3817	2194.3
	PA156 X IMC67	1079	1620	1859	2823	2934	3662	2329.5
	PA138 X SCA9	857	1278	1433	2422	3063	3742	2132.5
	PA173 X SCA9	667	1063	1471	2575	2850	3449	2012.5
	IMC67 X SCA9	975	1300	1400	2416	2466	2816	1895.5
	MEAN	866.2	1284.0	1557.0	2608.8	2864.0	3497.2	2112.9

Dry bean yields of PBC clones at HMPB PRANG BESAR Research Station, Kajang, Selangor Malaysia (1980s onwards)

CLONE	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y	11Y
PBC 113	337	987	1268	1583	1767	1742	1904	2547	1379	1330	1794
PBC 123	606	808	1552	1842	1833	1513	2007	1469	1451	2078	1879
PBC 130	402	899	1483	1671	2232	2958	3112	2474	1970	1730	2357
PBC 131	460	1086	1354	1448	2203	1782	1490	1496	1657	1925	2556
PBC 127	394	1066	1342	1694	1971	2173	1972	1498	1674	1714	2058
PBC 139	630	874	1540	2100	2246	1584	1469	1275	1581	1843	1800
PBC 140	665	784	1677	2424	2179	1868	1995	1982	1516	1811	2134
PBC 159	322	913	1366	1529	2348	1860	1984	1823	1928	1967	2140
PBC 178	204	512	858	1604	1579	2170	2570	2674	1886	1658	1890
PBC 179	226	840	1042	1683	1817	2075	2106	2192	2348	2098	2414
MEAN	425	877	1348	1758	2018	1973	2061	1943	1739	1815	2102
HYBRID	252	446	688	1012	1085	968	958	891	820	798	904

Yield performance of some DOA Sabah clones at Agriculture Research Station, Quoin Hill Tawau Sabah Malaysia

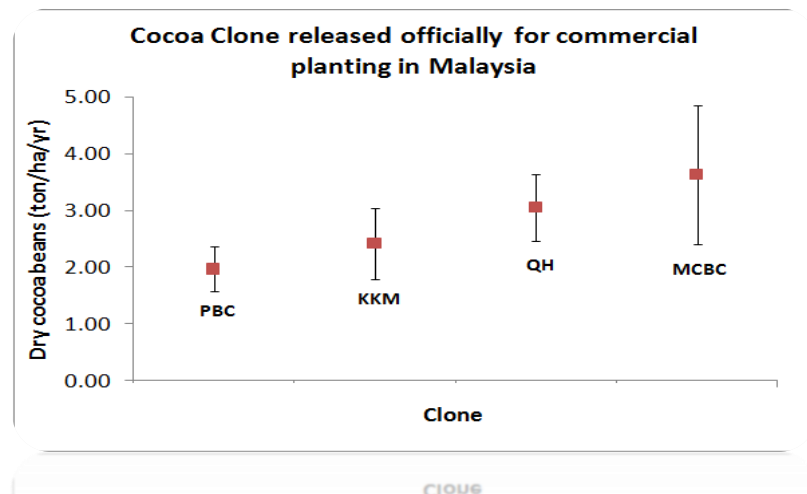
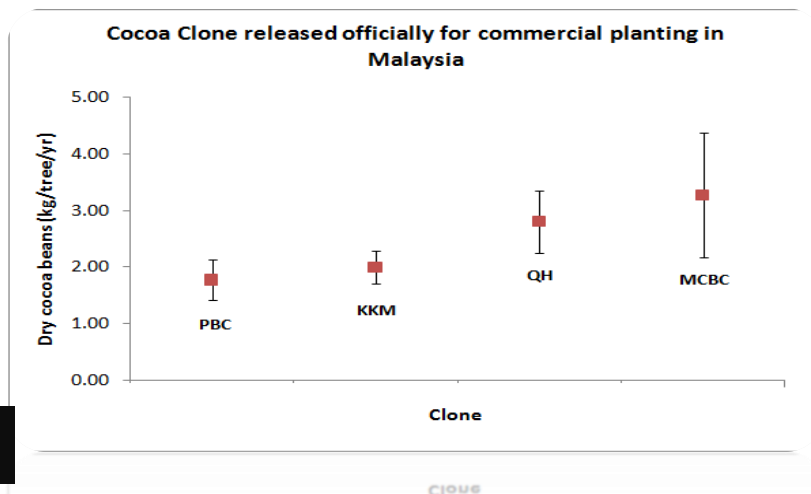
CLONE	DRIED BEAN YIELD (kg/ha)							
	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	MEAN
BR 25	2543	3189	3930	3986	2445	3038	2249	3054
QH 22	2209	2473	3182	3190	2530	2886	2134	2658
QH 441	3561	3729	4371	3020	2274	2897	1981	3119
QH 186	3604	2958	3440	3096	2082	2910	2022	2873
QH 240	2652	2850	3786	2468	1943	3030	2399	2733
QH 37	2507	3348	3885	2767	2689	3649	2493	3048
PBC123	2948	4770	3295	4240	3719	1643	1552	3167
KKM 22	2194	3746	2351	2704	2319	1520	1410	2321

- i) The early hybrid planting materials showed that evaluation by the 5th year of production about 1 ton/ha of dry cocoa beans was achieved and the yield subsequently was rather consistent and would fluctuate within a 30% variation as is expected for open field plantings depending on environmental factors of sunshine, rain, fertiliser inputs and tree management.
- ii) Clonal planting materials developed showed that by the 5th year production achieved 2 tons/ha and the subsequent years fluctuate within the same band in view of the environmental factors expected to interfere.

Cocoa clones released officially for commercial planting in Malaysia – Comparison on the pod, dry bean production/tree and per ha recorded

Clone	Pods (No./tree/yr)		Dry cocoa Beans (kg/tree/yr)		Dry cocoa beans (ton/ha/yr)	
	Mean	Std	Mean	Std	Mean	Std
PBC	38.84	9.50	1.77	0.36	1.97	0.39
KKM	47.40	8.59	2.00	0.29	2.42	0.62
QH	67.18	16.00	2.80	0.56	3.05	0.58
MCB	62.40	20.71	3.27	1.10	3.63	1.22

Correlation of productivity to selected cocoa clones released for planting



MALAYSIA COCOA CLONES

53

- Introduction
- Clones Technical Information
- Class I Clones

6

KKM 22
MCBC 1
PBC 123
QH 1003
MCBC 8

MCBC 10

- Class II Clones

17

BR 25	KKM 1	KKM 4
KKM 5	KKM 19	KKM 25
MCBC 9	PBC 112	PBC 137
PBC 139	PBC 221	QH 22
RP 1	MCBC 11	MCBC 12
		MCBC 13
		MCBC 14

- Class III Clones

19

BAL 209	BAL 244	DESA 1
KKM 2	KKM 6	KKM 15
KKM 17	KKM 26	KKM 27
KKM 28	MCBC 2	MCBC 4
MCBC 6	MCBC 7	PBC 159
PBC 179	QH 37	QH 326
QH 1176		

- Class IV Clones

11

KKM 3	MCBC 3	MCBC 5
PBC 130	PBC 131	PBC 140
QH 186	QH 240	QH 441
QH 968	QH 1287	

12



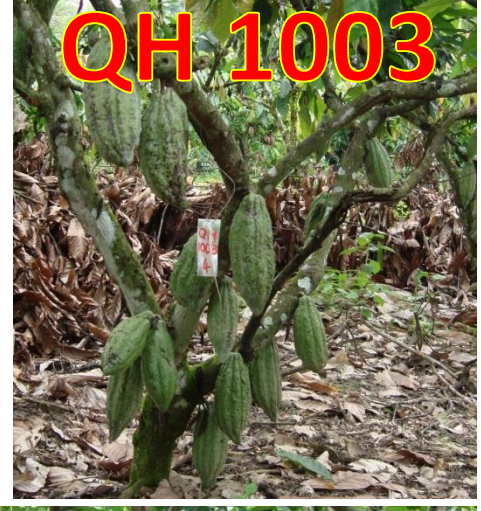
MCBC 10



PBC 123



QH 1003



MCBC 1



KKM 22

MCB's Cocoa Clones

MALAYSIAN COCOA BOARD 1ST SERIES CLONE FEATURES



MCBC 1 MCBC 2 MCBC 3 MCBC 4 MCBC 5

MALAYSIAN COCOA BOARD 3RD SERIES CLONE FEATURES



MCBC 10

MCBC 11

MCBC 12

MALAYSIAN COCOA BOARD 2ND SERIES CLONE FEATURES



MCBC 6

MCBC 7

MCBC 8

MCBC 9

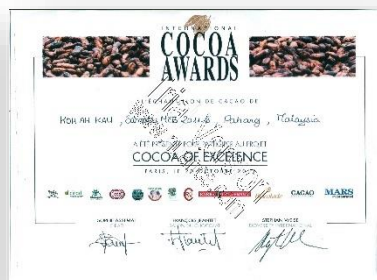


MCBC 13



MCBC 14

THE INTERNATIONAL COCOA FLAVOR COMPETITION IN PARIS FRANCE FOR THE YEAR 2011 AND 2013



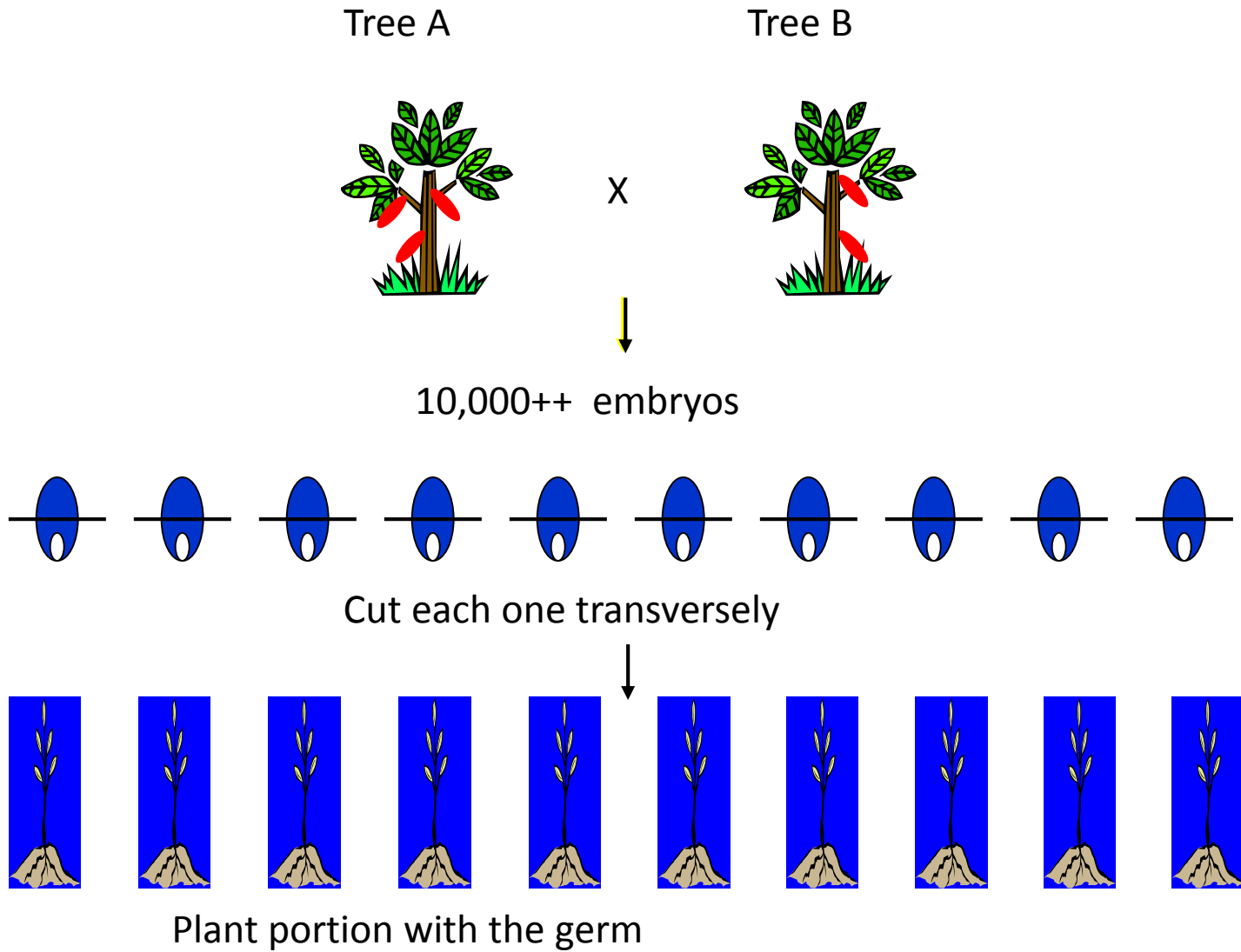
FARMER'S NAME	LIST OF CLONES
KOH AH KAU	KKM: 1, 5, 22, 25, ICS: 84, 95, GS29 PBC: 112, 123, 130, 131, 137, 139, 140, 159
CYRIL AK LANGIN	KKM: 19, 22, 25, BR25, PBC123, MCB: C2, C5, C10, RP1
JANDA AK JELIAN	BR25, PBC123, KKM: 1, 5, 22
HJ. AHMAD SAPARI	KKM: 1, 4, 5, 22, 25, 27 PBC: 123, 131, 140, 159, 221, 230, 236 MCBC: 1, 2, 3, 4, 5, 6, 7, 8, 11 QH : 1003, 1176, 1346

MCB Time Tunnel Technology: Single Bean Analysis

The unseen world of cocoa beans

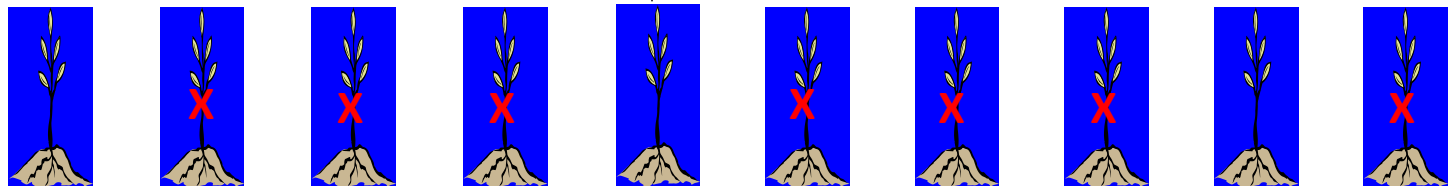


Single Bean Analysis



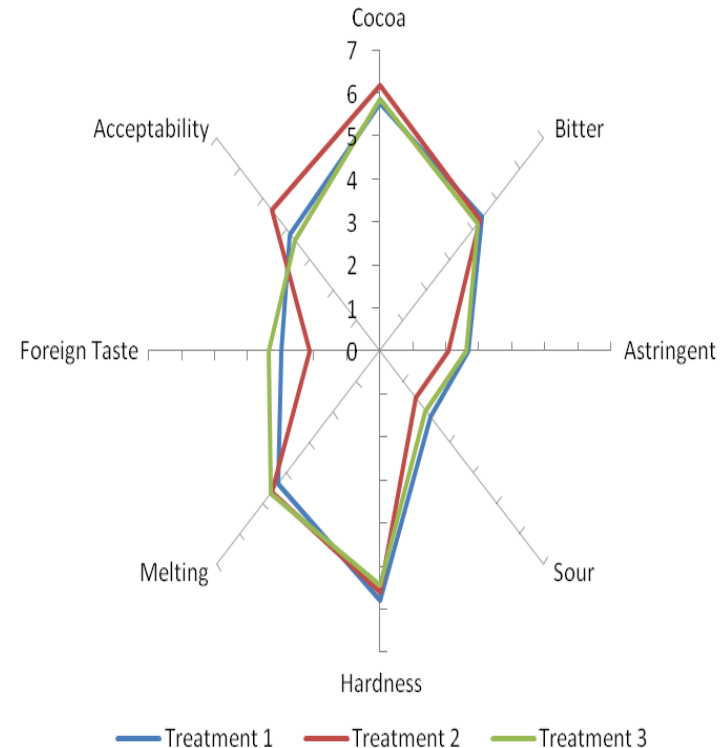
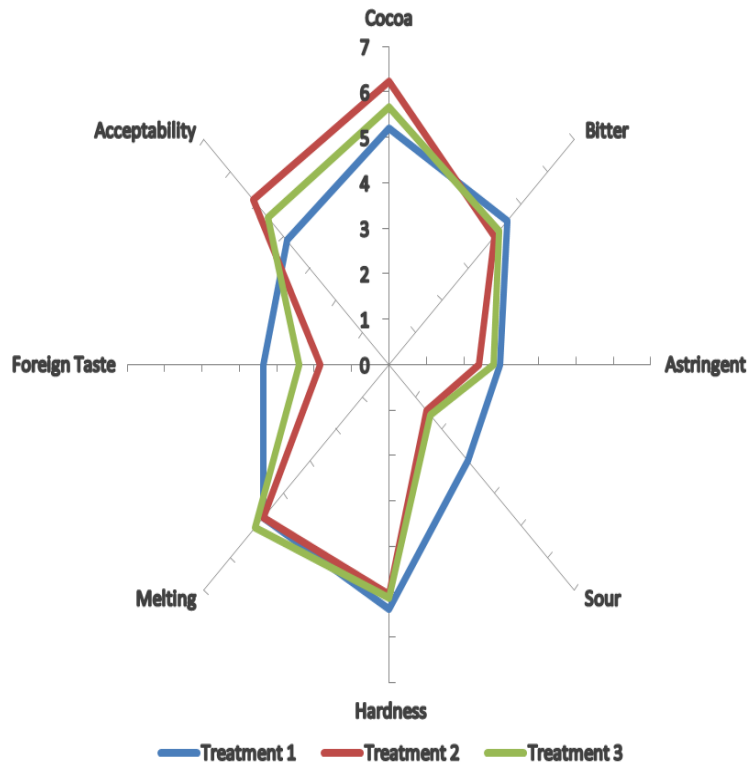
Analyze

- ◆ Flavan-3-ols (Procyanidins): Astringent and reduce cocoa flavor precursors
Want low for high cocoa flavor
Want high for health chocolate
- ◆ Caffeine and theobromine: Bitter
Want low for low bitterness
Want high caffeine for stimulating beverage
- ◆ Storage proteins: Generates flavor precursors - always want high
- ◆ Aroma note (nutty, fruity, floral) compounds



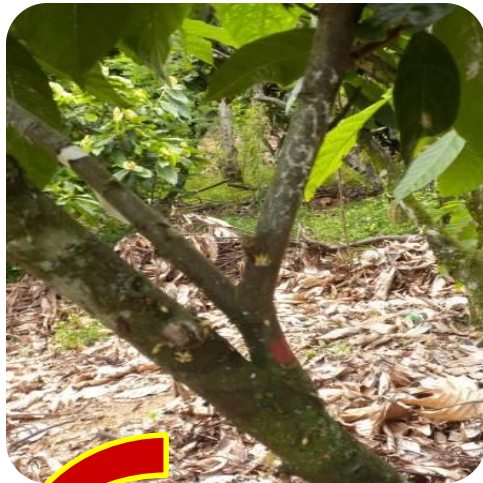
Flavanols	-	-	+	-	+	-	+	-	+	+
Caffeine/Theobro	-	-	+	-	+	+	-	+	-	+
Storage proteins	+	-	-	+	+	-	-	+	+	-
Aroma notes	-	-	+	-	+	-	-	-	+	-
Good mol markers	+	-	-	-	+	+	-	-	+	-
Agronomic traits)										

THE FEASIBILITY OF ORGANIC COCOA IN MALAYSIA

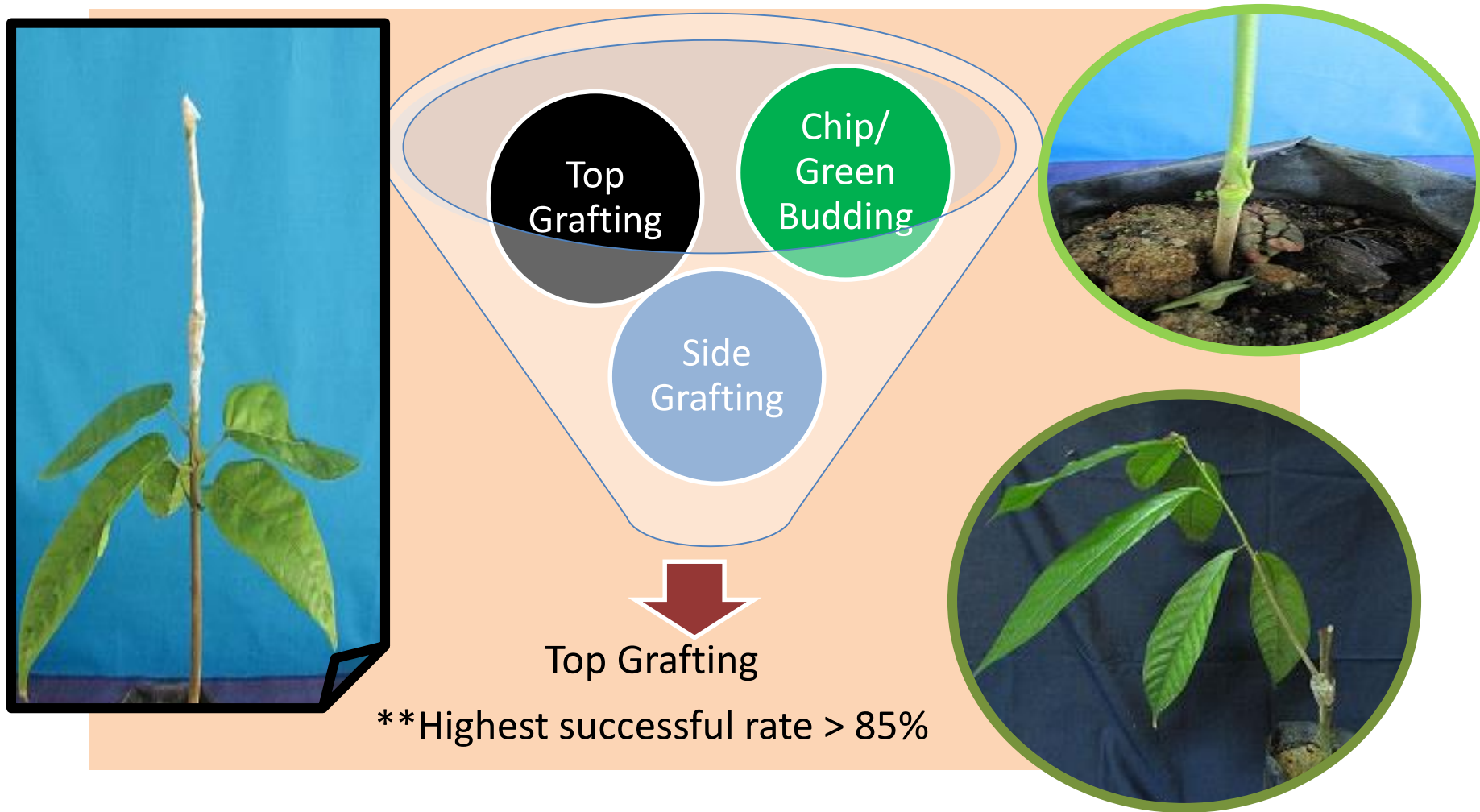


Established organic farming do have advantages in cocoa cultivation in terms of yield production, the soil and leaf analysis, bean quality and its flavour. In spite of higher cost on established organic farming, suggestion for other material selection which is cheaper and accessible should be taken as an alternative replacement. Organic price premium are also expecting to absorb the cost of production later in the future, though the market for premium price is still unavailable in Malaysia due to its niche market. (Source: Boney, 2014)

Programme of Rehabilitation on Less Productive Mature Cocoa Trees Through Canopy Replacement



Dissemination of Recommended Clones to Farmers Through Selected Propagation Method



R&D FUNDS RECIEVED

Funds received in Malaysia Plan	Total Allocation received
9 th Malaysia Plan (2006 – 2010)	MYR5.2 million (USD1.3 million)
10 th Malaysia Plan (2011 – 2015)	MYR5.6 million (USD1.4 million)
11 th Malaysia Plan (2016 – 2020)	33.6 million (USD8.4 million)

R&D FUNDS RECEIVED, 2016

Type of fund	Total Allocation received (MYR)
Sciencefund	92,000
Technofund	1.8 million
Temporary Research Fund (TRF)	275,000
Development Fund	14.2 million
International Project	325,000
National Project	37,000
TOTAL	16.7 million

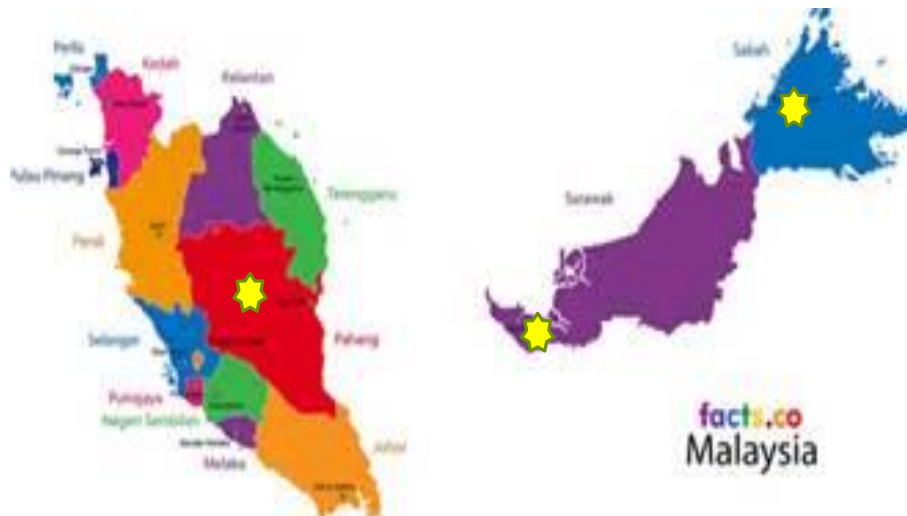
10th Malaysia Plan (2011-2015)

- 3 programmes:
 - New cocoa planting
 - Increase cocoa productivity
 - Rehabilitation of cocoa

11th Malaysia Plan (2016-2020)

- **Development of Cocoa Cluster**
 - ✓ Involves three states in Malaysia (Pahang, Sabah & Sarawak)
 - ✓ Farm-to-Table concept
- ★
- Create a niche market for **unique flavor** (nutty, fruity, floral & spicy) through biotechnology programmes.

MALAYSIA PLAN



MALAYSIA IS HEADING TOWARDS...



1. Cocoa Value Chain

- From Farm to Table

- Niche market by producing cocoa beans with unique flavors, thus increase the household income for cocoa farmers

2. Target **>50%** of cocoa farmers are planting the recommended clones especially Class I clones.

- Currently, there are <50% of farmers use the recommended clones suggested by MCB.

- Constraints:

- a. Farmers have their own preferences in choosing clones

- b. Tend to use the clones which are available and convenient to them

3. Efforts from the government and private initiatives:

- a. Development of entrepreneurs in providing sufficient planting materials to the farmers

- b. Convince the farmers to plant recommended clones

- c. Increase farmers' knowledge during clone selection and awareness in spreading planting materials with P&D.



HAVE A **COCOA** BREAK !

**“MALAYSIAN COCOA IS
DELICIOUSLY NUTRITIOUS
AND GOOD FOR YOUR
HEALTH”**

Thank You