

A New Baby Corn Variety : Chiangmai 90 (CMB 8704)

**Prawit Puddhanon, Sakol Phetmanee, Penkhae Nattriphob,
Supachai Kaewmeechai, Suvit Punsurintr, Vichit Kajornmalee
Narongsak Senanarong and Vichitr Benjasil***

Abstract

The average result from 7 locations in 1989 rainy season confirmed that the baby corn variety CMB 8704 F₃ had prolific ears and high yield. It gave 1,133 kg/rai of baby corn ears with husk by which was 35 higher than that of standard variety Rangsit 1, and 9% higher than Suwan 2. Its 177 kg/rai of standard size ears was higher than that of the standard varieties by 63 and 19%. Similar results were obtained in the farmer trials. CMB 8704 F₃ ears could be harvested as fresh baby corn at 43 days, which was 1 day earlier than Suwan 2 and 5 days earlier than Rangsit 1. It was registered in 1990 as a new open-pollinated baby corn variety, Chiangmai 90, by the Department of Agriculture.

Keywords : corn, Chiangmai 90, CMB 8704

Baby corn (*Zea mays* L.) is the small young cob or female inflorescence of corn before pollination, consumed as a vegetable. Recently, the canning industry and frozen food company have made baby corn more important, resulting in the development of baby corn production on a large scale for exports. The quantity and export value of canned baby corn increased drastically during 1976–1988 (Table 1).

Table 1. Quantity and export value of canned baby corn during 1976–1988.

Year	Quantity (Tons)	Value (Million baht)
1976	235	3.58
1977	533	8.91
1978	489	9.53
1979	866	17.33
1980	916	21.38
1981	961	22.64
1982	1,495	36.52
1983	4,012	89.59
1984	4,482	101.13
1985	6,281	141.47
1986	11,316	230.62
1987	17,218	334.86
1988	23,396	451.33

Source : Export Service Centre, Department of Export Promotion.

* Chiangmai Field Crops Research Centre, Field Crops Research Institute, Sansai, Chiangmai 50210

However, the government has to develop improved production technology to assist baby corn farmers. The cheapest and easiest technology is a new variety. Chiangmai Field Crops Research Center is selecting new varieties with prolific ears, high yield, earliness and downy mildew disease resistance.

Materials and Methods

A flow chart showing yearly activities for baby corn improvement is shown in Figure 1.

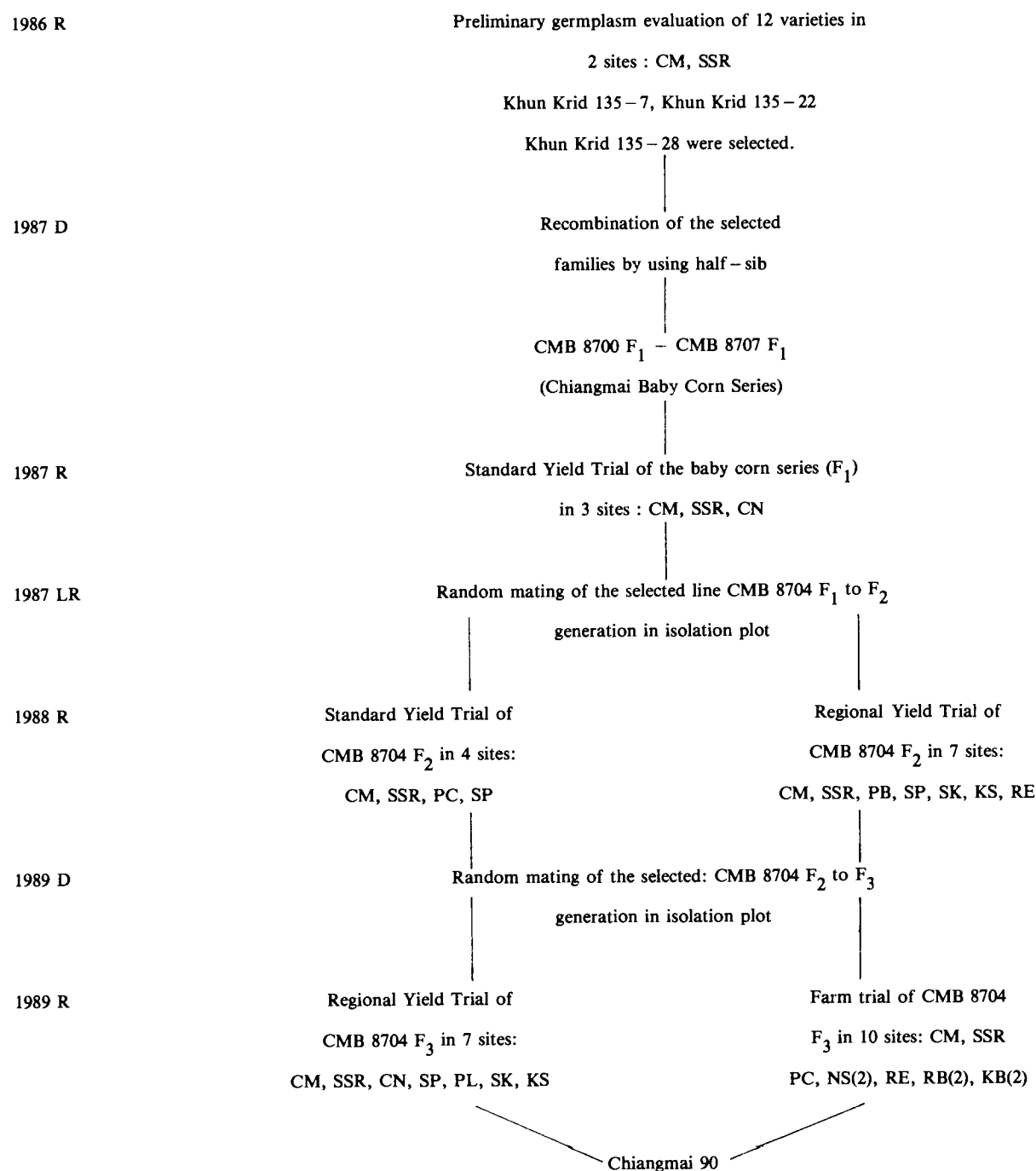


Figure 1. Improvement scheme for baby corn variety : CMB 8704.

Evaluation of field corn germplasm commenced in the 1986 wet season, with 12 varieties at 2 sites, Chiangmai Field Crops Research Centre and Srisumrong Field Crop Experiment Station. Plot size standard cultural practices were : planting distance 50 cm. between rows and 50 cm between hills, planted 3 seeds/hill; in plots 6.25×2 m, with 3 replications. 50 kg/rai of 15-15-15 fertilizer applied 2 times, before planting and 20 days after emergence. Pre-emergence herbicide, alachlor rate 600 cc/rai was applied after planting. Data were collected on number of baby corn ears harvested within 10 days, weight of baby corn ears with husk and weight of baby corn standard ears.

In the 1986-87 dry season, 3 elite families were selected to recombine with 6 other Khun Krid families in half sib crossing block. The ratio between female and male rows was 2 : 1 and the female rows were detasselled before pollen shedding. The pollen plants or male rows were a combination of Khun Krid 135-33 and Khun Krid 135-22 families. At harvesting the ears in each female family were collected and shelled separately in order to derive 9 varieties called the Chiangmai Baby Corn Series.

In the 1987 rainy season, the F_1 baby corn were tested in a Standard Yield Trial at 3 sites : Chiangmai and Chainat Field Crops Research Centres and Srisumrong Station. Four replications was used with 10 varieties including Rangsit 1 as standard check variety. Data were collected on number of harvested ears/plot, weight of ear with husk, weight of ear without husk, number of standard size ears, weight of standard size ears and ratio between weight of ear with husk and without husk.

In the late 1987 rainy season, the variety CMB 8704 F_1 was selected, then its remnant seed increased by random mating to F_2 generation in an isolation plot.

In the 1988 rainy season, the CMB 8704 F_2 population was compared with standard check varieties, Rangsit 1 and 2, Suwan 2, in a Standard Yield Trial at 4 sites; at Chiangmai, Suphan Buri, Pichit Research Centres and Srisumrong Station. In addition, the CMB 8704 F_2 variety was tested with baby corn hybrid varieties from private seed companies in a Regional Yield Trial, 7 sites at Chiangmai, Suphan Buri Field Crops Research Centers, Srisumrong, Praputthabat, Sakolnakhon, Karasin and Roiet Stations. Data were collected on weight of ear with husk and weight of ear standard size.

In the 1989 dry season, the variety CMB 8704 F_2 was again selected, then its remnant seed were increased by random mating to F_3 generation in isolation plot.

In 1989 rainy season, the CMB 8704 F_3 variety was tested with standard check varieties : Rangsit 1, Suwan 2 and hybrid varieties from private seed companies in Regional Yield Trial, 7 sites at Chiangmai, Chainat, Suphan Buri Field Crops Research Centres and Srisumrong, Pisanuloke, Sakolnakhon and Kalasin Station. In addition, the CMB 8704 F_3 variety was tested with the standard check varieties in a Farmer Trial, at 10 sites in Chiangrai, (CR) Chiangmai, (CM) Srisumrong, (S.SR) Pichit, (PC) Nakhonsawan (NS) (2) Roiet, (R) Ratchaburi (PB) (2) and Kanchanaburi (KB) (2) Provinces during dry and rainy season, with plot size was expanded to 400 squaremeters for each variety.

Results and Discussion

In the 1986 rainy season, the result of field corn germplasm evaluation (Table 2) showed that families Khun Krid 135 – 22, Khun Krid 135 – 7 and Khun Krid 135 – 28 produced 192 – 220 standard ears/plot compared to 105 ears/plot of standard check variety : Rangsit 1. This result implied that the 3 families were prolific and suitable for a baby corn improvement program. Weight

of standard ears, was 155 – 172 kg/rai compared with 120 for Rangsit 1 (Tepjun *et al.*, 1986).

In 1987 dry season the 3 families were recombined with other Khun Krid families in half – sib crossing block. Selection emphasized earliness and prolific ears, resulted in the derivation of 9 baby corn populations called CMB 8700 F₁ to CMB 8707 F₁ and CMB Composite F₁ or Chiangmai Baby Corn Series (Table 3.) (Puddhanon *et al.*, 1987).

Table 2. Number and weight of ears standard size, averaged from Preliminary Yield Trial at Chiangmai Field Crops Research Center and Srisumrong Field Crops Experiment Station in 1986 rainy season.

Variety	No. of ears (12.5 sqm.)	No. of std. ears (12.5 Sq.m.)	Weight of std. ears (kg/rai)	% Rel to ck
Khun Krid 135 – 22	235	211	172.7	145
Khun Krid 135 – 7	205	192	164.7	138
Rangsit 1 × Suwan 2	175	149	156.2	131
Khun Krid 135 – 28	237	220	155.0	130
Khun Krid 135 – 33	182	157	151.5	127
Rangsit1 (HS) C ₁ F ₁	173	135	150.3	126
Suwan 2 × Rangsit 1	190	170	147.7	124
TFE – 139(S) C ₁ F ₁	181	146	146.0	122
Suwan 2	191	169	128.2	107
Khun Krid 134 – 1	169	149	123.1	103
Rangsit1(S) C ₁ F ₁ (ck)	147	105	119.5	100
Rangsit Co.	127	98	104.9	88
Env.	**	**	**	
Var.	**	**	**	
Env. × Var.	ns	ns	ns	
L.S.D.(0.05)	42	41	21	
(0.01)	60	58	30	

Table 3. Pedigree of Chiangmai Baby Corn Series and amounts of F_1 seed collected from half sib recombination plot at Chiangmai Field Crops Research Center in 1987 dry season.

Variety	Pedigree	Amounts of F_1 seed (kg)
CMB 8700 F_1 (male)	Khun Krid 135-33 $\times$ 135-22	6.6
CMB 8701 F_1	Khun Krid 135-12 $\times$ male	1.2
CMB 8702 F_1	Khun Krid 135-57 $\times$ male	1.1
CMB 8703 F_1	Khun Krid 135-28 $\times$ male	1.3
CMB 8704 F_1	Khun Krid 135-7 $\times$ male	1.4
CMB 8705 F_1	Khun Krid 135-15 $\times$ male	1.2
CMB 8706 F_1	Khun Krid 135-53 $\times$ male	1.2
CMB 8707 F_1	Khun Krid 135-27 $\times$ male	1.8
CMB composite F_1	Balanced Composite seed of CMB 8701 - CMB 8707	1.2

In 1987 rainy season, the 9 baby corn populations were evaluated at Chiangmai, Chai Nat and Srisumrong. The result (Table 4.) showed that CMB 8704 F_1

was prolific and gave 24% higher weight of ears with husk and 43% higher weight of standard ears than Rangsit 1. Moreover, it was the earliest variety in

Table 4. Average of 5 baby corn characters in Standard Yield Trial, tested at Chiangmai, Chainat, Field Crops Research Center and Srisumrong Experiment Station in 1987 rainy season.

Variety	No. of harvested ears (12.5 sq.m)	Wt. of ears with husk (kg/rai)	% Rel to ck.	Wt. of ears without husk (kg/rai)	% Rel to ck.	No. of ears in std. size (12.5 sq.m)	Wt. of ears in std. size (kg/rai)	% Rel to ck.	Ratio w and w/o husk
CMB composite F_1	337	1084	117	227	106	237	114	96	5:1
CMB 8700 F_1	319	1106	120	225	105	225	145	121	5:1
CMB 8701 F_1	339	1091	118	225	106	248	151	126	5:1
CMB 8702 F_1	318	1134	112	232	109	235	161	135	5:1
CMB 8703 F_1	374	1083	117	238	112	273	154	129	5:1
CMB 8704 F_1	365	1143	123	275	129	262	171	143	4:1
CMB 8705 F_1	311	1146	124	226	106	223	175	146	5:1
CMB 8706 F_1	371	1102	119	244	114	219	150	126	5:1
CMB 8707 F_1	324	1061	115	224	105	239	155	129	5:1
Rangsit 1 (ck.)	216	925	100	213	100	151	120	100	4:1

the CMB Series. This implied that the selection pressure in the previous crop was efficient (Puddhanon *et al.*, 1987).

In the 1987 late rainy season, the remnant seed of the CMB 8704 F₁ were advanced by random mating to produce F₂ seed. The same selection pressure was practiced in the isolation plot.

The 1988 rainy season results showed that CMB

8704 F₂ was still prominent among all tested varieties including baby corn hybrids. On average from 4 locations it gave 19% higher weight of ears with husk and 43% higher weight of standard ears than Rangsit 1 the standard check variety (Table 5, 6). Similar results were obtained in 7 locations of the Regional Yield Trial, (Tables 7, 8) Puddhanon *et al.*, 1988).

Table 5. Average weight of baby corn ears with husk (kg/rai) of 4 varieties, tested in Standard Yield Trial at Chiangmai, Suphan Buri, Pichit and Srisumrong in 1988 rainy season.

Variety	CM	SP	PC	SSR	Ave.	% Rel to ck.
1. CMB 8700 F ₂	1,114	1,675	1,153 a	1,213 a	1,289	116
2. CMB 8704 F ₂	1,082	1,731	1,174 a	1,288 a	1,319	119
3. Suwan 2	1,001	1,448	1,023 a	1,009 b	1,120	101
4. Rangsit 1 (ck.)	1,055	1,368	798 b	1,231 b	1,113	100
Expt. mean	1,063	1,556	1,037	1,185		
C.V. (%)	7.2	14.4	12.2	12.2		

Table 6. Average weight of baby corn standard ears (kg/rai) of 4 varieties, tested in Standard Yield Trial at Chiangmai, Suphan Buri, Pichit and Srisumrong in 1988 rainy season.

Variety	CM	SP	PC	SSR	Ave.	% Rel to ck.
1. CMB 8700 F ₂	122 a	324 ab	199 b	179 b	206	123
2. CMB 8704 F ₂	130 a	377 a	241 a	209 a	239	143
3. Suwan 2	105 b	267 b	192 b	159 bc	181	108
4. Rangsit 1 (ck.)	95 b	277 b	151 c	145 c	167	100
Expt. mean	113	312	196	173		
C.V. (%)	7.2	16.5	14.1	9.2		

Table 7. Baby corn genotype groups response across 7 environments, classified by weight of ears with husk (kg/rai) from Regional Yield Trial in 1988 rainy season.

Genotype by environment means arranged by genotype groups											
Group	Entry	Entry	Env. Group								% Rel
No.	No.	Name	CM88	SR88	PB88	SP88	SKN88	KS88	RE88	G Means	to ck
3 NO =	1	GROUP MEAN	1675	1169	1276	1452	1369	1226	826	1285	
	3	CMB8704	1675	1169	1276	1452	1369	1226	826	1285	131
16 NO =	4	GROUP MEAN	1046	901	657	1447	951	1118	695	973	
	10	GX13410	1186	905	678	1472	1103	1186	664	1028	105
	8	G - 5402	1153	803	663	1424	974	1139	803	994	101
	7	HSSWDMR	963	748	593	1378	736	1136	691	892	91
	6	Rangsit	881	1147	695	1513	992	1009	620	980	100
17 NO =	5	GROUP MEAN	1257	1158	926	1656	1214	1219	770	1172	
	4	CMB8705	1113	1207	1086	1730	1349	1265	779	1218	124
	1	CMBCOM	1197	1139	1041	1542	1319	1234	832	1186	121
	5	Suwan 2	1039	1172	910	1547	1132	1223	772	1114	114
	9	G - 5435	1399	1027	775	1667	1122	1203	703	1128	115
	2	CMB8700	1538	1245	819	1794	1148	1173	766	1212	124
Env. mean			1214	1056	854	1552	1124	1179	745	1104	

Table 8. Baby corn genotype groups response across 7 environments, classified by weight of Standard ears (kg/rai), from Regional Yield Trial in 1988 rainy season.

Genotype by environment means arranged by genotype groups											
Group	Entry	Entry	Env. Group								% Rel
No.	No.	Name	CM88	SR88	PB88	SP88	SKN88	KS88	RE88	G Means	to ck
15 NO =	2	GROUP MEAN	113.8	190.3	105.4	159.1	220.8	214.4	91.4	156.5	
	4	CMB8705	106.8	205.8	103.2	186.8	224.0	216.6	94.9	162.8	127
	1	CMBCOM	120.8	174.8	107.7	131.4	217.6	212.3	88.0	150.4	118
16 NO =	3	GROUP MEAN	84.7	117.9	71.5	136.7	128.4	210.3	88.7	119.7	
	8	G - 5402	114.0	122.0	76.4	146.6	129.6	204.9	93.8	126.8	99
	6	Rangsit	66.0	151.8	74.9	137.3	146.6	222.6	94.3	127.6	100
	7	HSSWDMR	74.0	79.9	63.2	126.3	109.0	203.3	77.9	104.8	82
17 NO =	5	GROUP MEAN	163.2	168.9	102.9	159.0	176.4	212.4	91.5	153.5	
	9	G - 5435	166.0	154.7	92.1	178.6	169.3	217.3	89.1	152.4	119
	2	CMB8700	151.8	176.4	88.0	168.4	181.9	205.9	93.2	152.2	119
	10	CX13410	135.8	140.2	100.8	158.0	159.3	213.3	80.5	141.1	111
	5	Suwan 2	186.6	185.8	115.6	145.3	172.3	219.6	88.2	159.1	125
	3	CMB8704	176.0	187.5	117.8	145.1	199.0	204.9	106.7	162.4	127
Env. mean			129.8	157.9	93.9	152.4	170.9	212.1	90.7	143.9	

In 1989 dry season, the remnant seed of CMB 8704 F_2 were again advanced by random mating to produce F_3 seed. In addition, the same selection pressure was practiced in the isolation plot.

In 1989 rainy season, the CMB 8704 F_3 was tested again in Regional Yield Trials and Farmer Trials. The results reconfirmed the outstandings of CMB 8704 F_1 , F_2 in the last 2 years. The CMB 8704 F_3 was

early, its ears could be harvested within 43 days. Its production of standard ears was 64% higher than Rangsit 1, 19% higher than of Suwan 2. (Table 9.) (Puddhanon *et al.*, 1989). Similar results were obtained in the farmer Trials (Table 10). Moreover, CMB 8704 F_3 was resistant to downy mildew. It was only 1.0% infected while susceptible check variety Tien was 96.0% infected (Table 11) (Titatan *et al.*, 1989). According

Table 9. Average days to harvest, weight of ears with husk, weight of standard ears, ratio between weight of ears with husk and weight of standard ears, tested in 7 Regional Yield Trials at Chiangmai, Chainat, Suphanburi, Pisanuloke, Sakolnakhon, Kalasin in 1989 rainy season.

Variety	Days to harvest (days)	Wt. of ears w/h (kg/rai)	% Rel to ck	Wt. of ears std. (kg/rai)	% Rel to ck	Ratio
1. CMB 8700 F_2	44	1,079	129	159	147	7:1
2. CMB 8704 F_3	43	1,133	135	177	164	6:1
3. CMB 8705 F_2	42	1,145	137	180	167	6:1
4. G-5403	46	876	105	140	130	6:1
5. G-5423	49	761	91	116	107	7:1
6. Cargill 727	47	778	93	119	110	7:1
7. Baby Corn Comp	43	1,051	126	168	156	6:1
8. Pac 1	48	905	108	140	130	6:1
9. Pac 2	48	823	98	123	114	7:1
10. NS 104	47	923	110	138	128	7:1
11. Suwan 2	44	1,040	124	148	137	7:1
12. Rangsit 1 (ck)	48	837	100	108	100	8:1
Average	46	946	113	143	133	7:1

Table 10. Average weight of ears with husk and ears standard size, tested in 10 Farmer Trials at Chiangrai, Chiangmai, Srisumrong, Pichit, Nakhonsawan (2), Roiet, Ratchaburi (2) and Kanchanaburi (2) in 1989 dry and rainy season.

Variety	Wt. of ear w/h (kg/rai)	% Rel to check	Wt. of std. ears (kg/rai)	% Rel to check
1. CMB 8704 F_3	1217	140	183	174
2. Suwan 2	977	113	157	150
3. Rangsit 1 (check)	867	100	105	100

to the 3 year results, and the advantages over Rangsit 1 variety (Table 12), this variety was registered in 1990 as a new open-pollinated baby corn variety by the

Department of Agriculture with the new name Chiangmai 90.

Table 11. Average percent of Downy mildew and Stock rot diseases, tested in screening nursery at Uthathani in 1989 R.

Variety	Downy mildew infection (%)	Stock rot disease (%)
1. CMB 8704 F ₂	2.2	3.8
2. CMB 8704 F ₃	1.0	3.8
3. CMB 8705 F ₂	2.0	3.6
4. CMS 8901	59.0	3.5
5. CMS 8902	52.0	3.5
6. CMS 8903	85.3	3.2
7. CMS 8904	75.0	3.4
8. HSSW (HS) C ₁ F ₂	16.0	3.4
9. HSSW DMR	9.0	3.6
10. KASET KHAOW	8.1	3.1
11. SRTW 8801 F ₂	96.0	3.6
12. CMP 8700	78.2	3.7
13. TIEN (check)	96.0	4.0

Table 12. Comparison of Agronomic characters between Chiangmai 90 and standard variety Rangsit 1.

Agronomic characters	CM 90	Rangsit 1
1. Downy mildew infection	7.4	54.9
2. 50% Tasselling date (days)	39.0	46.0
3. 50% silking date (days)	44.0	50.0
4. Plant height (cm.)	200.0	197.0
5. Ear height (cm.)	125.0	129.0
6. Days to harvest (fresh ears)	43.0	48.0
7. Harvesting period	10.0	14.0
8. No. of ears per plant	2.8	1.9
9. Wt. of ears with husk (kg/rai)	1,133.0	837.0
10. Percent standard ear (%)	71.4	69.6
11. Wt. of ears standard size (kg/rai)	177.0	108.0
12. Ratio wt.w/h and w/o husk	6:1	7:1
13. Young cob color	Yellow	Yellow
14. Grain type	Yellow flint	Orange semi flint
15. Days to harvest (dry ears)	105-110	110-120
16. Wt. of fresh stocks (tons/rai)	4.3	5.6

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