



## A High Yielding Multiple Disease Resistant TNAU Maize Hybrid Co 6 for Tamil Nadu

G. Nallathambi\*, K.N. Ganesan, P.M. Tamilarasi, Sain Dass, K. Thiyagarajan,  
P. Veerabhadhiran, V. Paranidharan and S. Sridharan

Department of Millets, Tamil Nadu Agricultural University, Coimbatore-641 003

TNAU maize hybrid Co 6 (CMH-08-282) is a high yielding single cross hybrid (UMI 1200 x UMI 1230) and matures in 110 days. It is suited for cultivation both under irrigated (June - July & November - December) and rainfed (September - October) conditions. A total of 100 adaptive research trials, 16 multi location trials, 138 on farm trials, 9 station trials and 49 All India trials were conducted with single cross hybrid CoH(M) 5 as check and popular private maize hybrids viz., 900 M (G) and NK 6240 as checks. Under irrigated condition, it recorded a mean grain yield of 7359 kg/ha with 28.2, 10.6 and 8.2 per cent increased grain yield over the existing hybrid Co(H)M 5 (5739 Kg/ha), 900 M (G) (6656 Kg/ha) and NK 6240 (6803 Kg/ha) respectively. Under rainfed conditions the same hybrid recorded a mean grain yield of 4906 kg/ha with 16.6, 19.0 and 21.6 per cent increased grain yield over checks viz., CoH(M) 5 (4209 Kg/ha), 900 M (G) (4121 Kg/ha) and NK 6240 (4034 Kg/ha) respectively. It recorded a highest yield of 13273 Kg/ha (JH Agri, Bangalore) and 19 tonnes of fodder under irrigated condition. It exhibited a multiple disease resistance against the Sorghum downy mildew, Turcicum leaf blight and Post flowering stock rot and moderately resistant to stem borer. It possesses high starch (76.30%), high protein (11.25%) and high beta-carotene (0.48 mg/100g) with moderate level of fat (4.65%) and crude fibre (1.25%) than the check hybrids. Grains are bold, orange yellow, semi dent in texture. It recorded a high shelling (81%) with high test weight (400 g /1000 seeds). Hybrid seed production is much easier since male and female parents can be sown simultaneously for flowering synchronization. In view of high yielding with stable performance across environments, it has been released as new hybrid during 2012 for commercial exploitation in the state of Tamil Nadu.

**Keywords :** TNAU Maize Hybrid Co 6, Single Cross Hybrid, Multiple disease resistance

In India maize is emerging as third most important cereal after rice and wheat that provides food, feed and fodder and serves as a source of basic raw material for the number of industrial products viz., starch, oil, protein, alcoholic beverages, food sweeteners, cosmetics, biofuels etc. Maize occupies an important place as a source of human food (25%), animal feed (12%) and poultry feed (49%), starch (12%), brewery (1%) and seed (1%). The growth rate of area (2.83%), production (30.93%) and productivity (27.35%) over the past years, has shown a remarkable increase as compared to other principal cereal crops in India.

The focused research on single cross hybrid helped in addressing several issue of biotic and abiotic stresses. The success story of single cross hybrids in US corn belt is well known. Its impact has been realized in China, Brazil, Canada and many other countries. With the adoption of single cross hybrid technologies in USA during 1960s has increased the productivity from 3.5 t/ha (1960) to 9.68 t/ha (2008). In India the productivity remained

less than one ton per ha for many decades compared to USA. After shifting to single cross hybrid technology (2006-08), India has witnessed 30% increase in production and 27% increase in productivity within two years with the coverage of just 20% area under single cross hybrids. There is also an increase of 15% in production and more than 12% increase in productivity.

The similar impact is also observed in Tamil Nadu due to adoption of single cross hybrid technology, the area and productivity have steadily increased than other millets. At present, the area under maize has exceeded 2.87 lakh hectares (2008-09) with the production of 12.6 lakh tonnes and the productivity of 4389 kg/ha (Anonymous, 2011). Hence, there is a witnessing impact on production and productivity of maize, the maize breeding objectives were reoriented towards developing single cross hybrids with biotic resistance and suitable for food and animal feed industries.

\*Corresponding author email: [nthambi2002@yahoo.co.in](mailto:nthambi2002@yahoo.co.in)

## Materials and Methods

A total of 215 single crosses were synthesized by utilizing 45 elite inbred lines at Department of Millets, Tamil Nadu Agricultural University, Coimbatore. All these hybrids were evaluated with the existing check hybrid Co H(M) 5 and popular private hybrids 900 (M) gold and NK 6240 during 2008. Among these hybrids, about 20 % of hybrids were forwarded to the next stage of Advanced Hybrid trial at Research station. Under advanced hybrid trial, the superior performing single cross maize hybrid CMH-08-282 was identified as high yielding and nominated to test under multi location trial in

different research station during 2009. Since it was performing well under MLT, it has been promoted to test under Adaptive Research Trial during 2010-11 under farmers holding of different districts of Tamil Nadu. The same hybrid was also evaluated simultaneously under On Farm Trials (2009) and All India Trials (2009-2010). Further, this hybrid was evaluated for reaction to pest (Stem borer) and diseases (Sorghum downy mildew, post flowering stock rot and turcicum leaf blight) under artificial and field conditions. As the quality is the prime concern of the industries, the hybrid was subjected to quality analysis including starch (%), Protein (%), Fat (%), Beta carotene (mg/100 g) and Crude Fibre (%).

**Table 1. Overall mean performance of CMH-08-282 in different trials conducted both under irrigated and rainfed situations (2008-2011).**

S. No.	Name of the trial	No. of trials	Grain yield (Kg/ha)			
			TNAU Maize Hybrid Co 6	CoH(M)5	900 M (G)	NK 6240
<b>I. Irrigated</b>						
1.	Research station trials	7	9527	6953	9185	9446
2.	Multi Location Trials	12	5752	4642	5706	5999
1.	All India Trials	49	7904	-	-	-
4.	On Farm Trials	103	8286	6350	-	-
5.	Adaptive Research Trials	90	5326	5010	5076	4963
	Mean	261	7359 (261)	5739 (212)	6656 (109)	6803(109)
	% over CoH(M) 5		28.23	#	-	-
	% over 900 (M) G		10.56	-	#	-
	% over NK 6240		8.17	-	-	#
<b>II. Rainfed</b>						
1.	Research station trials	2	6655	5410	6497	6347
2.	Multi Location Trials	4	2285	2138	2689	2604
3.	On Farm Trials	35	7470	6293	-	-
4.	Adaptive Research Trials	10	3215	2993	3177	3151
	Mean	51	4906 (51)	4209 (51)	4121 (16)	4034 (16)
	% over CoH(M) 5		16.56	#	-	-
	% over 900 (M) G		19.04	-	#	-
	% over NK 6240		21.62	-	-	#
<b>III. Overall Mean (Irrigated &amp; Rainfed)</b>						
			6269 (312)	4974 (263)	5388 (125)	5418(125)
	% over CoH(M) 5		26.34	#	-	-
	% over 900 (M) G		16.35	-	#	-
	% over NK 6240		15.71	-	-	#

Note: Figures in parenthesis are number of trials

## Results and Discussion

Out of 261 trials laid out under irrigated situations, the TNAU maize hybrid Co 6 recorded an average grain yield of 9527 kg/ha compare to hybrid checks viz., Co H(M) 5 (6953 kg/ha), 900 (M) Gold (9185 kg/ha) and NK 6240 (9446 kg/ha) under station trials conducted during 2008 to 2011 (Table 1). The same hybrid under station trial in rainfed situation registered an average yield of 6650 kg/ha.

In multi location trials conducted under irrigated condition at different research stations during 2009-10, the TNAU maize hybrid Co 6 recorded an average yield of 5752 kg/ha while the grain yield of 4642, 5706 and 5999 kg/ha were recorded by the CoH(M) 5, 900 (M) Gold and NK 6240 respectively.

The same high yielding hybrid tested under 49 location in all over India have registered a average grain yield of 7904 kg/ha (110 days) with maximum potential yield of 13273 kg/ha was recorded by JK Agri, Bangalore.

Out of 103 on farm trials conducted in one acre area in different districts of Tamil Nadu along with the existing check hybrid CoH(M) 5 both under irrigated and rainfed conditions revealed that the TNAU maize hybrid Co 6 have recorded an average yield of 8286 kg/ha whereas COH(M) 5 recorded 6350 Kg/ha under irrigated situation which is 30.5% higher than the CoH(M)5. Similarly OFTs organized under rainfed situation has also registered an increase of 18.70% over CoH(M) 5 (Table 2). The

**Table 2. Performance of maize hybrid TNAU Maize Hybrid Co 6 in On Farm Trials (OFTs) (1 Acre) under Irrigated and Rainfed situations (2009 & 2010)**

S. No. Districts	Locations	Yield (Kg/ha)	
		TNAU Maize Hybrid Co 6	CoH(M)5
<b>I. Irrigated</b>			
1. Erode	8	8443	6139
2. Tiruppur	17	8092	6347
3. Thiruvalluvar	10	8332	6192
4. Coimbatore	28	8405	6317
5. Tanjore	4	8356	5977
6. Dindigul	2	8602	6073
7. Karur	9	8382	6761
8. Salem	15	8204	6654
9. Trichy	5	8019	6346
10. Tindivanam	2	8105	6574
11. Madurai	3	8096	6543
Overall Mean	103	8286	6350
	% over CoH(M)5	30.49	#
<b>II. Rainfed</b>			
1. Coimbatore	4	7866	6847
2. Erode	2	7083	6052
3. Tiruppur	4	7356	6131
4. Karur	2	7743	6437
5. Salem	10	7721	6310
6. Trichy	5	7680	6287
7. Tindivanam	6	6762	6040
8. Madurai	2	7358	6305
Overall Mean	35	7470	6293
	% over CoH(M) 5	18.68	#

crop yield competition organized by the Department of Agriculture officials in one of the on farm trials of TNAU maize hybrid Co 6 under rainfed situation in Vadakkipalayam (Pollachi) recorded an yield of 2200

**Table 3. Performance of maize hybrid CMH-08-282 in ART's under irrigated and rainfed condition in different districts of Tamil Nadu (2010 & 2011)**

S. Centers No.	Location	TNAU Maize Hybrid Co 6	Yield (Kg/ha)		
			Check Hybrids		
			CoH (M)5	900 M (G)	NK 6240
<b>I. Irrigated</b>					
1. Pudukkottai	4	6186	4460	4968	5975
2. Trichy	4	4158	3862	4528	3980
3. Madurai	6	4909	4490	4949	4730
4. Cuddalore	5	4553	4501	4389	4224
5. Villupuram	3	6168	4973	6110	6043
6. Dharmapuri	10	4843	4599	4506	4417
7. Salem	10	6647	5699	5793	6132
8. Sivagangai	3	8383	8006	8442	8018
9. Karur	3	3320	3191	3110	2790
10. Thirupur	2	4217	4622	4331	4604
11. Namakkal	6	4861	5230	5479	5416
12. Krishnagiri	6	5038	5578	4526	4437
13. Perambalur	1	5300	5016	5800	4096
14. Kancheepuram	6	4480	5372	4487	4572
15. Tirunelveli	6	5258	3228	4623	3589
16. Coimbatore	3	6383	4052	6209	6101
17. Erode	6	6766	6854	5785	5866
18. Thiruvallur	2	3536	3688	3323	3971
19. Theni	3	4033	4233	4117	4241
20. Virudhunagar	1	4050	4200	4100	4200
Overall Irrigated mean	90	5326	5010	5076	4963
% over CoH(M) 5		6.31	#	-	-
% over 900 (M) G		4.93	-	#	-
% over NK 6240		7.31	-	-	#
<b>II. Rainfed</b>					
Villupuram	1	2966	1754	2754	2869
Pudukkottai	1	2750	2550	2600	2650
Madurai	1	2967	2750	2883	2800
Trichy	3	3285	3215	3387	3267
Perambalur	2	3675	3545	3773	3720
Karur	1	3140	3075	2850	2760
Thiruvallur	1	3120	3062	2982	3188
Overall rainfed mean	10	3215	2993	3177	3151
% over CoH(M) 5		7.42	#	-	-
% over 900 (M) G		1.20	-	#	-
% over NK 6240		2.03	-	-	#

kg from measured area of 50 cents and estimated to be 11t/ha.

The ART conducted under irrigated situations during Kharif 2010 and Rabi 2010-11 exhibited an yield of 5236 kg/ha from 90 farmers holdings (Table 3). However, the check hybrids viz., CoH(M) 5, 900

**Table 4. Reaction of parents and hybrids to major disease and pests under field and artificial condition (2009 & 2010).**

Inbred line/ Hybrid	Coimbatore		Mandya	Hyderabad	Coimbatore
	Sorghum Downy Mildew (%)		Turcicum Leaf Blight (1-5 scale)	Post Flowering Stock Rot (1-5 scale)	Stem Borer (1-9 scale)
	Field	Artificial	Artificial	Artificial	Field
UMI 1200	3.04	6.66	-	-	
UMI 1230	3.47	8.69	-	-	
<b>TNAU Maize</b>					
Hybrid Co 6	2.06	6.81	2.5	4.4	5.55
CoH(M) 5 (c)	8.45	19.51	-	-	8.33

Pest: *Chilo partellus*. Maximum possible leaf injury score per plant is 9.

(M) Gold and NK 6240 have recorded an average yield of 5010, 5076 and 4963 Kg/ha with percentage increase of 6.3, 4.9 and 7.3 % respectively. The overall percentage increase in grain yield of TNAU

**Table 5. Quality analysis for the kernels of the TNAU Maize maize hybrid Co 6.**

S. No. Quality traits	TNAU Maize Hybrid Co 6	CoH(M)5 (Check)
1. Starch (%)	76.30	75.20
2. Protein (%)	11.25	10.42
3. Fat (%)	4.65	4.72
4. Beta carotene (mg/100 g)	0.48	0.29
5. Crude Fibre (%)	1.25	1.33

maize hybrid Co 6 under different trials was 26.3%, 16.3% and 15.7 % over the check hybrids CoH(M) 5, 900 (M) Gold and NK 6240 respectively (Table 1).

The hybrid exhibited a multiple disease resistance against the diseases viz, Sorghum downy mildew, Turcicum leaf blight and Post flowering stock rot and moderately resistant to stem borer with leaf injury scale of 5.5 under field condition (Table 4). It possesses special attributes such as high starch (76.30 %), high protein (11.25%) and high beta-carotene (0.48 mg/100g) with moderate level of fat (4.65 %) and crude fibre (1.25%) (Table 5) . The grains are bold, orange yellow in colour and semi dent in texture. The cobs are fully covered with husk and recorded a high shelling (81%) with high test weight (400 g /1000 seeds). The hybrid seed production is also much easier since male and female parents can be sown simultaneously for flowering synchronization.

The hybrid matures in 110 days and classified under maturity. It has distinguishable and identifiable morphological characters of anthocyanin pigmentation present on the leaf sheath and brace root, grains are orange yellow in colour and semi dent in texture (Table 6).

**Table 6. The morphological features of TNAU maize hybrid Co 6 and its parents.**

Morphological traits	: TNAU Maize Hybrid Co6	UMI 1200 (F)	UMI 1230 (M)
Days to 50% pollen shed (days)	: 58-62	60-64	61-65
Days to 50% silking (days)	: 60-62	61-63	63-68
Duration (days)	: 107 - 110	112-115	116-118
Stem	: Green	Green	Green
Stem: Anthocyanin colouration of brace root	: Present	Present	Present
Plant: Length up to flag leaf	: Long	Long	Long
Leaf: Anthocyanin colouration of sheath	: Present	Present	Present
Leaf: Attitude of blade	: Curved	Straight	Curved
Leaf: Width of blade	: Medium	Narrow	Broad
Leaf Sheath pubescence	: Sparse	Sparse	Sparse
Tassel: Time of anthesis	: Medium	Medium	Late
Tassel: Anthocyanin colouration at base of glume	: Present	Present	Present
Tassel: Anthocyanin colouration of glumes excluding base	: Present	Present	Present
Tassel: Anthocyanin colouration of anthers	: Present	Present	Present
Tassel: Density of spikelets	: Lax	Dense	Lax
Tassel: Angle between main axis and lateral branches	: Large	Small	Large
Tassel: Attitude of lateral branches	: Curved	Straight	Curved
Tassel: Number of primary and lateral branches	: Many	Few	Many
Tassel: Length of main axis above lowest side branch	: Long	Medium	Long
Tassel: Length of main axis above upper side branch	: Medium	Short	Medium
Ear: Time of silk emergence	: Early	Early	Late
Ear: Anthocyanin colouration of silks	: Present	Present	Slightly present
Ear placement	: Long	Long	Long
Ear: length of peduncle	: Short	Short	Short
Ear: Length without husk	: Long	Medium	Medium
Ear: Diameter without husk	: Large	Medium	Medium
Ear: Shape	: Cylindrical	Cylindrical	Cylindrical
Ear: Number of rows of grains	: Many	Medium	Medium
Ear: Type of grains	: Semi dent	Dent	Flint
Ear: Colour of top of grains	: Orange yellow	Orange	Yellow
Ear: Colouration of glumes of cobs	: Light purple	Light purple	White
Kernel: Row arrangement	: Straight	Straight	Rarely irregular
Kernel: Poppiness	: Absent	Absent	Absent
Kernel: Sweetness	: Absent	Absent	Absent
Kernel: Waxiness	: Absent	Absent	Absent
Kernel: Opaqueness	: Absent	Absent	Absent
Kernel: Shape	: Round to indented	Round	Round
Kernel: 1000 kernel weight	: 390 - 400 g	250-290 g	190-220 g

Considering its superior performance in grain yield, disease resistance and grain quality, and ease in hybrid seed production, the hybrid culture CMH 08-282 was released as TNAU maize hybrid Co 6 during 2012 for commercial cultivation in maize growing districts of Tamil Nadu.

#### Reference

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