

COH (M) 4 : A new three way cross maize hybrid for Tamil Nadu

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Abstract: COH (M) 4 is a medium duration (90-95 days) maize hybrid suited for cultivation both under rainfed (Sept.-Oct.) and irrigated (June-July and Jan-Feb) conditions. It has a yield potential of 11422 kg of grains and 19.0 tonnes of fodder per hectare. This hybrid is moderately resistant to downy mildew disease and maize stem borer. It possesses desirable characters such as high starch (70.90%), protein (11.12%) and fat (5.08%). For hybrid seed production, the female UMI 90 x UMI 285 (F_1) is to be sown first and 4 days after that, male parent UMI 112 can be sown with the ratio of 6:2. The cobs are fully covered with husk and the percentage of seed set is very high. Grains are bold, yellow in colour and flint in texture. It is recommended for cultivation in Tamil Nadu in the place of COH 3 maize hybrid.

Key words : COH (M) 4, Three way cross maize hybrid, Medium duration, Starch, Fat.

Introduction

Maize (*Zea mays* L.) is one of the most versatile crops and can be grown over a diverse environmental conditions. It is very well used at a higher level in industries than any other cereal grains because of its very high production potential, wider adaptability and specific industrial value (Kannaiyan *et al.* 2000). At present, it is considered as an important industrial crop due to its greater demand as raw material for poultry and animal feed. Tamil Nadu had three fold increase in the area under maize for the past ten years. Now, the current area under maize is about 1.2 lakh ha. with the production of 1.9 lakh tonnes and with the productivity of 1609 kg ha⁻¹ (AICRP, 2000). Therefore, development of high yielding maize hybrid with pest and disease resistant will play a major role in increasing the production and productivity of maize crop to meet the growing demand in this state. With this objective, breeding work was initiated and a new high yielding COH (M) 4 maize hybrid was developed.

Materials and Methods

An experiment was conducted by involving inbred lines and 30 three way cross hybrids obtained from them along with a check hybrid COH 3 at Department of Millets, Tamil Nadu

Agricultural University, Coimbatore during 1993-94. Among thirty hybrids evaluated, (UMI 90 x UMI 285) x UMI 112 was found to be superior based on *per se* performance and heterosis, which was later promoted as UMH 28 for the advanced stages of testing.

The hybrid UMH 28 (COH(M) 4) was further tested under multilocation trial (MLT) at different research stations of the Tamil Nadu Agricultural University during 1994-95. It was promoted to Adaptive Research Trial (ART) during 1995-96 and was tested in farmers holdings in collaboration with the State Department of Agriculture and All India Coordinated trial during 1997-98. Laboratory studies were conducted to evaluate the quality traits *viz.* protein (Humphries, 1956), starch (Clegg, 1956) and oil content with the help of Nuclear Magnetic Resonance Spectrometer (Oxford 4000 series) available at TNAU, Coimbatore and the results are discussed below.

Results and Discussion

The maize hybrid culture UMH 28 was tested in station trials from 1993 to 2001 at Coimbatore. It recorded an average grain yield of 7587 kg ha⁻¹, which is 16.6 and 36.8 per cent more over checks COH 3 and CO 1

Table 1. Performance of maize hybrid culture UMH 28 in station trials (Coimbatore, 1993-2001).

Year	Grain yield kg ha ⁻¹					
	Irrigated			Rainfed		
	UMH 28	CoH3	Co1	UMH 28	CoH3	Co1
1993 (K)	7850	6258	5388	5842	5148	4946
1994 (K)	6722	6944	5379	-	-	-
1994 (R)	6110	5984	5210	-	-	-
1995 (K)	7950	6110	5442	6150	5885	5240
1995 (R)	7740	6000	5340	-	-	-
1996 (K)	7210	7112	5352	5719	5298	4922
1996 (R)	6795	5892	5330	-	-	-
1997 (K)	7900	6333	5400	7291	5833	5010
1997 (R)	6416	5643	4037	-	-	-
1998 (K)	9628	7750	7166	-	-	-
1998 (R)	6416	5643	4037	-	-	-
1999 (K)	8792	8125	7042	5055	5111	4944
1999 (R)	6553	5253	4811	-	-	-
2000 (K)	9333	8254	7508	6145	5025	4900
2000 (R)	7431	5799	5319	-	-	-
2001 (K)	8542	7045	5945	-	-	-
Mean	7587	6509	5544	6034	5383	4994
% of CoH 3	116.6	100.0	85.2	112.1	100.0	92.8
% on Co 1	136.8	117.4	100.0	120.8	107.8	100.0

K - Kharif; R- Rabi

respectively in irrigated condition. The same hybrid in rainfed situation recorded an average grain yield of 6034 kg ha⁻¹, which is 12.1 and 20.8 per cent more over COH 3 (5883 kg ha⁻¹) and CO 1 (4994 kg ha⁻¹) respectively (Table 1). The hybrid culture UMH 28 was also tested in multilocation trials during 1994-95. It recorded an average grain yield of 4866 kg ha⁻¹, whereas the checks COH 3 and CO 1 recorded 3419 kg ha⁻¹ and 2874 kg ha⁻¹ under irrigated condition. It is about 42.3 and 69.3 per cent increased grain yield over COH 3 and CO 1 respectively. Under rainfed condition, it recorded an average grain yield of 3773 kg ha⁻¹ with 12.5 and 13.7 per cent increase over COH 3 and CO 1 respectively (Table 2).

The stability in yield performance of UMH 28 was confirmed through 95 adaptive research trials (irrigated-42 locations and

rainfed-53 locations) conducted for four year from 1995-96 to 1998-99 in nine districts of Tamil Nadu (Table 3). The results of 42 location in irrigated situations revealed that the hybrid culture UMH 28 (4221 kg ha⁻¹) was superior to the check hybrid COH 3. It registered 6.1 and 12.8 per cent higher grain yield than hybrid COH 3 (3956 kg ha⁻¹) and composite CO 1 (3743 kg ha⁻¹) respectively. Considering the rainfed condition the hybrid culture UMH 28 recorded the grain yield of 3757 kg ha⁻¹ with 9.6 and 25.2 per cent increased grain yield over check COH 3 (3427 kg ha⁻¹) and CO 1 (3001 kg ha⁻¹) respectively.

In All India coordinated trials, the hybrid culture UMH 28 was tested in 22 locations (1997-98). It recorded an average grain yield of 6103 kg ha⁻¹ in 95 days with 4.0 and 14.5 per cent increased yield over the national

Table 2. Performance of hybrid culture UMH-28 in multilocation trials during 1994 - 95

Location	Grain yield (kg ha ⁻¹)		
	UMH 28	UMH 10 (COH 3)	CO 1
<i>Irrigated</i>			
Chennai	4074	2981	2516
Chilpatti	2180	764	417
Chukottai	6354	4167	3020
Coimbatore	6854	5762	5542
Chennai	4866	3419	2874
on COH 3	142.3	100.0	84.1
on CO 1	1693	119.0	100.0
<i>Rainfed</i>			
Channaisagar	5231	5098	5248
Coimbatore	6230	5620	5472
Chennai	3613	3278	3354
Chilpatti	1746	1359	1254
Chidhachalam	1744	1792	2083
Chukottai	4074	2981	2516
Chennai	3773	3355	3318
on COH 3	112.5	100.0	98.9
on CO 1	113.7	101.1	100.0

Table 3. Performance of hybrid culture UMH-28 in ART under different districts of Tamil Nadu (1995-96 to 1998-99)

District	Grain yield (kg ha ⁻¹)							
	Irrigated				Rainfed			
	No. of trials	UMH 8	COH 3	CO 1	No. of trials	UMH 28	COH 3	CO 1
Chennai	6	4246	3776	3196	11	4460	4084	4083
Chennai	-	-	-	-	4	3492	3667	3231
Chidigul	16	4862	4679	4409	11	3461	2985	2975
Coimbatore	9	3850	3148	3049	13	3645	3481	3362
Charmapuri	2	3255	3365	3550	5	3794	3260	4038
Chukottai	2	3532	3284	2049	5	3517	2701	1704
Chalem	3	4722	4600	5064	3	3922	3994	3081
Madurai	2	2495	2425	2850	1	2315	2176	1481
Chamakal	2	4746	4171	3965	-	-	-	-
Mean	42	4221	3956	3743	53	3757	3427	3001
% on COH 3		106.7	100.0	94.6		109.6	100.0	87.6
% on CO 1		112.8	105.7	100.0		125.2	114.2	100.0

Table 4. Performance of hybrid culture UMH-28 under All India trials (1997-98)

Name of the Centre	Grain yield (kg ha ⁻¹)			
	UMH 28	KH 510 (ch)	Deccan 107 (ch)	Navjot (ch)
<i>Kharif 97-98 (Irrigated)</i>				
Arbhavi (Karnataka)	3999	5131	4714	3665
Mandya (Karnataka)	6664	7654	5741	4859
Proagro (Karnataka)	9804	11661	8919	8792
Coimbatore (T.N)	6394	8315	7467	5803
Udaipur (Rajasthan)	9570	11324	9346	8259
Godhra (Gujarat)	2800	2455	3042	2273
Chhindwara (M.P)	6514	6603	6153	5272
Almora (U.P)	6375	7322	5190	4916
Bajaura (H.P)	6410	7677	6277	6516
Ludhiana (Punjab)	3818	3785	3454	3774
Karnal (Haryana)	6143	5870	6014	6170
Kanpur (U.P)	4546	4078	4186	3617
Mean	6116	6822	5875	5326
% on KH 510 (ch)	90.0	100.0	86.1	78.1
% on Deccan 107 (ch)	104.0	116.1	100.0	90.6
% on Navjot (ch)	114.8	128.1	110.3	100.0
<i>Rabi 97-98 (Irrigated)</i>				
Jorhat (Assam)	6202	5664	-	7243
Ludhiana (Punjab)	4832	4063	-	4037
Karnal (Haryana)	5055	6820	-	3983
Kanpur (U.P)	5740	6514	-	5667
Bahraich (U.P)	4333	4872	-	3869
Jashipur	4235	5177	-	4837
Baka Kanchan Ganga	11422	13479	-	8486
Arbhavi	7010	6092	-	4400
Coimbatore (T.N)	6629	8698	-	5655
Banswara	5416	5411	-	5115
Mean	6087	6679	-	5324
% on KH 510 (ch)	91.1	100.0	-	79.8
% on Navjot (ch)	114.2	125.3	-	100.0
Over all Mean	6103	6757	5875	5328
% on KH 510 (ch)	90.3	100.0	86.9	78.8
% on Deccan 107 (ch)	103.9	115.0	100.0	90.7
% on Navjot (ch)	114.5	126.8	110.3	100.0

Black Deccan 107 and Navjot respectively. It has an yield potential of 11422 kg ha⁻¹ of grains and 19.0 tonnes of fodder per hectare (Table 4).

The overall mean performance of hybrid culture UMH 28 revealed that, in irrigated condition, it recorded an average grain yield of 5694 kg ha⁻¹ with 23.0 and 40.4 per cent increased grain yield over the existing hybrid COH 3 (4628 kg ha⁻¹) and composite CO 1 (4053 kg ha⁻¹) respectively. The same hybrid in rainfed condition, recorded an average grain yield of 4521 kg ha⁻¹ which is 12.0 and 20.0 per cent increase over that of COH 3 (4055 kg ha⁻¹) and CO 1 (3771 kg ha⁻¹) respectively (Table 5).

UMH 28 matures in 90-95 days with plant height of 215-225 cm. The stem is mostly green and rarely pink in colour. Pubescence is seen on the leaves and sheaths. The grains are bold, yellow and flint in texture. The cobs are fully covered with husk and

the percentage of seed set is very high. The female parent UMI 90 x UMI 285 should be sown first and 4 days after that, the male parent UMI 112 may be sown in the ratio of 6:2 (Table 6).

The hybrid culture UMH 28 is moderately resistant to sorghum downy mildew disease and maize stem borer (Table 7). It possesses desirable attributes such as higher starch (70.90%) and fat (5.08%) than hybrid COH 3 (Table 8). In view of its superior performance, maize hybrid culture UMH 28 was released as COH (M) 4 during January 2002 for commercial cultivation in Tamil Nadu.

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Table 5. Mean performance of hybrid culture UMH-28 in different trials conducted both in irrigated and rainfed situations

Name of the trial		Grain yield (kg ha ⁻¹)		
		UMH 28	COH 3	CO 1
<i>Irrigated</i>				
Location trials	(1993-2001)	7587	6509	5544
Multilocation trials	(1994-1995)	4866	3419	2874
All India trials	(1997-1998)	6103	-	-
Adaptive research trials	(1995-1999)	4221	3956	3743
Mean		5694	4628	4053
Over COH 3		123.0	100.0	87.6
Over CO 1		140.4	114.2	100.0
<i>Rainfed</i>				
Location trials	(1993-2000)	6034	5383	4994
Multilocation trials	(1994-1995)	3773	3355	3318
Adaptive research trials	(1995-1999)	3757	3427	3001
Mean		4521	4055	3771
Over COH 3		112.0	100.0	93.0
Over CO 1		120.0	107.0	100.0

Table 6. Description of parents and hybrid of COH (M) 4

Morphological characters	Single cross parents		Three-way cross parents		Hybrid COH (M) 4
	UMI 90	UMI 285	UMI 90 x UMI 285	UMI 112	(UMI 90 x UMI 285) x UMI 112
Plant height (cm)	195-205	190-200	217-226	163-168	215-225
Stem color	Green	Mostly green, rarely pink	Mostly green, rarely pink	Mostly green, rarely pink	Mostly green, rarely pink
Leaves	Pubescent with white hairs at leaf base	Pubescent leaves	Pubescent leaves, wavy nature	Pubescent leaves, erect type	Pubescent leaves
Cob	Occurs in 7-9 th node	Occurs in 6-8 th node	Occurs in 6-8 th node	Occurs in 7-8 th node	Occurs in 6-8 th node
Days to 50% silking	59-63	53-55	54-58	53-55	54-55
Days to 50% tasselling	53-57	49-53	57-60	54-57	54-56
Maturity (days)	100-105	90-95	95-100	90-95	90-95
Synchronization	Female parent should be sown 7 days in advance to male parent	Male parent should be sown 7 days after sowing the female parent	Female parent is to be sown first	Male parent is to be sown 4 days after sowing the female parent	-
Grain color/texture	Yellow flint	Orange flint	Orange flint	Yellow flint	Orange Yellowish flint
Seed yield (kg/ha)	1800	2200	2500	1900	3000

Table 7. Reaction of parents and hybrids to major diseases and pests under field and artificial conditions, n Coimbatore

Parent line/ Hybrid	Diseases		Pests
	Downy mildew (%)		Stem borer (1-9)
	Field	Artificial	Field
PM 90	0.8	-	-
PM 285	0.0	-	-
PM 112	0.0	-	-
PMH 28	4.0	20.0	2.0
PMH 3 (ch)	0.0	6.0	4.0
PM 1 (ch)	0.0	47.0	6.0

Table 8. Quality analysis of maize samples

Sample	Protein (%)	Fat (%)	Starch (%)
PMH 28	11.12	5.08	70.90
PMH 3 (ch)	11.12	5.00	70.55
PM 1 (ch)	11.86	5.10	70.23

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