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Research Article

Hybrid CO2 - A high yielding sunflower hybrid for Tamil Nadu

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Abstract
The importance of hybrids in sunflower has increased recently because of their higher seed yield compared with cross-pollinated varieties. Hybrids of sunflower are more stable, highly self-fertile, with high yield performance, and more uniform at maturity. Hybrid CO2 has been released as a high yielding sunflower hybrid suitable for Tamil Nadu during 2010. This hybrid was tested in station trials, Multi-Location Trial, Adaptive Research Trial, AICRP trials and On Farm Trials. Based on the overall performance, this hybrid has the potential of 1950 and 2230 kg/ha seed yield under *kharif* and *rabi* / summer situations respectively. The yield increase over Sunbred 275 and TCSH 1 are 13.4 and 17.1 per cent respectively under *kharif* conditions. Similarly, in *rabi* / summer conditions, this hybrid out yielded Sunbred 275 and TCSH 1 by 12.9 and 15.9 per cent respectively. This hybrid has high oil content of 39.8 per cent on seed basis and high volume weight (48 g/100 ml).

Key words
Sunflower, hybrid, Hybrid CO2, seed yield

Introduction

The sunflower (*Helianthus annuus* L., 2n = 34) belongs to the family *Compositae*. It is one of the three crop species along with soybean and rapeseed which account for approximately 78% of the world vegetable oil. Heterosis of this crop has been exploited only over the past few decades. Hybrid sunflower became a reality with the discovery of cytoplasmic male sterility and effective male fertility restoration system during 1970. Hybrids are preferred by farmers due to high yield and quality potential, homogeneity, same time maturity and easy possibility of cultural applications worldwide. Hybrid vigor has been the main driving force for acceptance of this oilseed crop. The importance of hybrid cultivars in sunflower has increased recently because of their higher seed yield compared with cross-pollinated varieties in many countries in the world. Hybrids of sunflower are more stable, highly self-fertile, with high yield performance, and more uniform at maturity (Seetharam, 1979 and Kaya, 2005).

Materials and methods

A CGMS male sterile line, COSF1A and a restorer line, CSFI99 were crossed and named as CSFH 5060 during 2005 at the Department of Oilseeds, TNAU, Coimbatore. Based on the performances in preliminary and advanced station trials, this hybrid was promoted to Multi-Location Trial followed by Adaptive Research Trials. Simultaneously this hybrid was also tested in All India Coordinated Trials and On Farm Trials.

Results and discussion

Hybrid CO2 is a high yielding hybrid with high oil content and high volume weight. It matures in 85-90 days. This hybrid has high oil content (39.8%) and high volume weight (40g/100ml). This hybrid was tested in station trials, Multi-Location Trial, Adaptive Research Trials, On Farm Trials and ICAR Co-ordinated trial along with popular hybrid checks like Sunbred 275 and TCSH 1. Overall this hybrid has been tested in 153 trials across various locations. Based on the overall performance in various trials, this hybrid has the potential of 1950 and 2230 kg/ha seed yield under *kharif* and *rabi* / summer situations respectively. The yield increase over Sunbred 275 and TCSH 1 are 13.4 and 17.1 per cent respectively under *kharif* conditions. Similarly, in *rabi* / summer conditions this hybrid out yielded Sunbred 275 and TCSH 1 by 12.9 and 15.9 per cent, respectively. (Table 1). Hence, this hybrid CSFH 5060 was released as Hybrid CO2 by the State Variety Release Committee during 2010 for Tamil Nadu.

Station Trials: Hybrid CO2 recorded 2431 and 2890 kg/ha seed yield during *kharif* and *rabi*/summer seasons respectively. It is 16.9 and 10.4 per cent increase over Sunbred 275 (2080 and 2619 kg/ha) and 20.3 and 29.4 per cent increase over TCSH 1 (2021 and 2235 kg/ha) during *kharif* and *rabi*/ summer seasons, respectively.

Multilocation Trials: Hybrid CO2 recorded 1826 and 2198 kg/ha during *kharif* and *rabi*/summer seasons respectively. The yield represents an increase of 15.0 and 26.3 per cent over Sunbred 275 (1587 and 1741 kg/ha) and 18.0 and 11.3 per cent over TCSH 1 (1548 and 1975 kg/ha) during *kharif* and *rabi*/summer seasons respectively.

Adaptive Research and On Farm Trials: Hybrid CO2 recorded an average seed yield of 1826 and 1907 kg/ha during *kharif* and *rabi*/summer seasons

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respectively, which is 11.3 and 8.2 per cent higher than Sunbred 275 (1640 and 1763 kg/ha) and 15.4 and 9.8 per cent increase over TCSH 1 (1582 and 1737 kg/ha) during *kharif* and *rabi*/summer seasons respectively.

All India Coordinated Trial: Hybrid CO2 recorded 1742 kg/ha during *Kharif* season. It is 10.3 per cent increased seed yield over KBSH 1 (1580 kg/ha) (Table 2).

Quality: This hybrid has high oil content of 39.8 per cent as compared to other hybrids *viz.*, Sunbred 275 (37.0%) and TCSH 1 (37.6 %) on seed basis. It also recorded high volume weight (48 g/100 ml) when compared to other check hybrids namely Sunbred 275 (38.6 g/100 ml) and TCSH 1 (42 g/100 ml) (Table 3).

Reaction to major disease under field and controlled conditions: Alternaria leaf spot: Hybrid CO2 recorded moderate resistant reaction to *Alternaria* disease incidence (5 score), while checks TCSH 1 (7 score) and Sunbred 275 (5 score) recorded susceptible and moderately resistant reaction (Table 4).

Rust: Hybrid CO2 recorded resistant reaction to rust disease incidence (3 score) while check TCSH 1 (3 score) and Sunbred 275 (3 score) recorded resistant reaction.

Necrosis: Hybrid CO2 recorded less necrosis disease incidence (8 %) when compared to 10 % and 8 % in TCSH 1 and Sunbred 275, respectively.

Reactions to major pests: Hybrid CO2 recorded less incidence of Thrips and Leaf Hopper (8.3 and 12.0 per plant respectively) when compared to TCSH 1 (12 and 15 per plant respectively) and Sunbred 275 (13 and 14 % respectively). *Helicoverpa* incidence was also less in Hybrid CO2 (0.2/plant) compared to TCSH 1 (0.5/plant) and Sunbred 275 (1.5/plant) (Table 5).

Distinguishing morphological characters of parental lines of the hybrid and the hybrid are depicted in table 6 and 7. Notification number of the hybrid and IC number of the hybrid and parental lines are given table 8.

References

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Table 1. Overall performance of Hybrid CO2 in various trials for seed yield (kg/ha)

Name of the trial	No. of locations	Hybrid CO2	Sunbred 275	TCSH1
Kharif				
Station trials	5	2431	2080	2021
MLT	8	1826	1587	1548
OFT 2008	8	1766	1569	1428
OFT 2009	7	2154	1864	1808
ART 2008	52	1559	1486	1511
Overall Mean	**80**	**1947**	**1717**	**1663**
% over Sunbred 275		**13.40**		
% over TCSH 1		**17.08**		
***rabi* / summer**				
Station trials	4	2890	2619	2235
MLT	8	2198	1741	1975
OFT 2007-08	24	2512	2288	2249
ART 2008-09	37	1302	1238	1225
Overall Mean	**73**	**2226**	**1971**	**1921**
% over Sunbred 275		**12.94**		
% over TCSH 1		**15.88**		

Table 2. Performance of Hybrid CO2 in AICRP trials during IHT- *kharif* 2008 (Seed yield kg/ha)

Location	Hybrid CO2	KBSH 1
Krishidhan seeds, Jalna	2115	1760
Latur	2047	1779
Nandyal	1185	1422
Nirmal Seeds, Pachora	1138	701
Advanta, Kurnool	2376	1739
Bengaluru	2343	2410
Coimbatore	1164	969
Raichur	1909	2013
Savalvihir	1399	1431
Overall Mean	**1742**	**1580**
% over KBSH 1	**10.25**	

Table 3. Oil and other quality parameters of Hybrid CO2

Traits	Hybrid CO2	Sunbred 275	TCSH1
Oil content (%)	39.8	37.0	37.6
Hull content (%)	26.5	32.0	28.0
100-seed weight(g)	5.52	3.95	4.85
Volume weight (g)/100 ml	47.8	37.6	42.0

Table 4. Disease reaction of Hybrid CO2 during *kharif* 2009

Disease	Hybrid CO2	Sunbred 275	TCSH1
Alternaria leaf spot (1-9 score)	5.0	5.0	7.0
Rust (1-9 score)	3.0	3.0	3.0
Necrosis (%)	8.0	8.0	10.0

Evaluated in infector row method with susceptible checks at every 10 rows of test entries. The susceptible checks were artificially inoculated with disease inoculum. No control measures were undertaken.

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Table 5. Pest reaction of Hybrid CO2 during *kharif* 2009

Pest	Hybrid CO2	Sunbred 275	TCSH1
Thrips/plant	8.3	13.0	12.0
Leaf hopper /plant	12.0	14.0	15.0
Helicoverpa armigera per head (Mean of 10 plants)	0.2/plant	1.5/plant	0.5/plant

Evaluated in infector row method with susceptible checks at every 10 rows of test entries. No control measures were undertaken.

Table 6. Distinguishing morphological characters of parental lines of the hybrid

Characters	COSF 1A (Female parent)	CSFI 99 (Male parent)
Plant height (cm)	145 – 165	145 – 170
Stem	Mostly green colour stem & Non-branching	Mostly green colour stem & Non-branching
Leaves	20 – 25 leaves Slightly serrated leaves	20 – 25 leaves Prominently serrated leaves
Pigmentation	Stray to nil purple pigmentation on the stem and petiole	Stray to nil purple pigmentation on the stem and petiole
Head	Flat to convex head	Flat to convex head

Table 7. Distinguishing morphological characters of hybrid

Characters	Hybrid CO2
Plant height (cm.)	160-175 cm
Leaves	Moderately serrated leaves Green colour
Head diameter	Medium head size Flat to convex head
Days to 50 % flowering	Medium head size Flat to convex head
Days to maturity	50 – 55 days
Seed colour	Dark brown seed coat and occasional longitudinal stripes can be seen on the seed surface
100-seed weight (g)	5.0-5.5
Hull content (%)	26.0 – 28.0
Oil content (%) (seed)	38-40
Volume weight (g /100ml)	45 – 48
Maturity	50- 55 days (50% flowering) 85 – 90 days (seed to seed)

Table 8. Notification number of the hybrid and IC number of the parental lines

Hybrid/Parental lines	IC number	Notification number
Hybrid CO2	IC585832	1708(E)/26.06.2012
COSF1A	IC296476	-
CSFI99	IC585833	-