



## Research Article

# Sorghum K 12(TKSV 0809) - A high yielding dual purpose sorghum variety for southern district of Tamil Nadu

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### Abstract

Sorghum K 12 (TKSV 0809) is a high yielding dual-purpose sorghum variety identified for winter rainfed vertisol tracts of southern districts of Tamil Nadu. TKS 0809 is a hybrid derivative of the cross SPV 772 x S 35-29 and evolved with an objective of development of high yielding dual-purpose short duration sorghum variety suitable for winter rainfed vertisol tracts of Tamil Nadu. TKS 0809 was released as Sorghum K 12 variety to replace the existing variety K 8 during 2015 from Agricultural Research Station, Kovilpatti. K 12 sorghum is a short duration variety which matures in 95-100 days. K 12 sorghum is a photo insensitive variety suitable for growing in all seasons of Tamil Nadu against the ruling variety K8 which is photosensitive and suitable for Kharif season only. It recorded an average grain yield of 3123 kg/ha under the rainfed condition which is 22.4 and 23.9 per cent increased over the check K 8 and CSV 17 respectively. The K 12 Sorghum exhibited a potential grain yield of 5801 kg/ha under summer irrigated condition which is 139.3 per cent increased yield over check variety K 8. K 12 sorghum (TKSV 0809) is a dual-purpose variety with an average dry fodder yield of 11.9 tonnes /ha. The dry fodder yield was 31.8% increased yield over local check K 8 and 40.7% over zonal check CSV 17. The grains are creamy white in colour and suitable for cooking, popping, flaking and other value-added products. It is moderately resistant to shoot fly, stem borer and resistant to downy mildew.

### Keywords

Sorghum (K 12), high yielding, grain and fodder.

## INTRODUCTION

Sorghum (*Sorghum bicolor* (L.) is the fourth important food crop in India, best-suited cereal crop for semi-arid environments. It is substantially popular among the farmers due to its greater adaptability and various forms of utility as grain, green fodder, Stover and silage. It is an important staple food grain after rice and wheat for millions of poor and most important food for insecure people in the semiarid tropics of India. Sorghum also offers great potential to supplement the fodder requirement of the growing dairy industry in India.

In Tamil Nadu, sorghum is grown in an area of 3.47 lakh hectares. Sorghum is a dual-purpose crop where both grain and fodder are highly valued outputs. It is therefore of paramount importance that technological developments

are extended to increase the productivity and sustainability of sorghum production in rainfed vertisol tracts. Sorghum K tall (hybrid) and K 8 are the Rabi sorghum specially adapted to the vertisol tracts of the southern region. The hybrid K tall is an early, high yielding dual-purpose hybrid but highly susceptible to lodging cause considerable fodder loss. Sorghum K 8 is a grain sorghum variety, meant for high-quality grains, but not suitable for fodder. Moreover it is suitable for Kharif season only due to photo sensitiveness. Under these circumstances, it is necessary to develop a short duration, dual-purpose photo- insensitive variety with high yield potential than K 8 sorghum for the rainfed vertisol tract. Breeding work had been initiated at Agricultural Research Station, Kovilpatti from 2008 to achieve the above

objective. Finally, it resulted in the development of a high yielding dual-purpose, photo insensitive sorghum culture TKSV 0809 (K 12) for rainfed vertisol tracts of southern districts of Tamil Nadu.

#### MATERIALS AND METHODS

Breeding work was initiated with F<sub>2</sub> segregating material received from the off-season nursery materials of AICSIP programme to evolve high yielding drought-tolerant sorghum variety. The F<sub>2</sub> segregating progenies of the cross involving high yielding line SPV 22 (female parent) with S 35-29 (male parent) was taken for the evolution of drought-tolerant variety. As an outcome of a superior segregant was identified as high yielding drought-tolerant dual-purpose line TKSV 0809 suitable for the rainfed vertisol tracts. The culture TKSV 0809 was tested in various yield trials viz., Replicated Row Yield Trial, Preliminary Yield Trial and Advanced Yield Trial at ARS, Kovilpatti from 2007-2012 along with local checks K 8,

CoS 28 and Co 30. In multi-location trial, TKSV 0809 was tested at various research stations of Tamil Nadu Agricultural University from 2009 to 12. The Adaptive Research trials were conducted in the farmer's fields of winter rainfed tracts during 2011-12 and 2012-13.

TKSV 0809 was also evaluated in the All India Co-ordinated Sorghum Improvement Project during 2010-2011 as SPV 2084 along with the national check CSV 17. The screening was done against important pests from Kharif 2010-2013 and for diseases during Kharif 2013. The grain and Stover samples were also analyzed for their quality by following standard methods.

#### RESULTS AND DISCUSSION

The culture TKSV 0809 was tested at ARS, Kovilpatti in various yield trials from 2007 to 2012 under rainfed condition, revealed that TKSV 0809 had a consistent performance with mean grain yield of 3570 kg/ha against

#### DUS characteristics of the Sorghum K 12

S. No.	Plant part	Characters	Sorghum K 12 (TKSV 0809)
1.	Seedling	Anthocyanin colour of the coleoptiles	Green
2.	<b>Leaf-sheath</b>	Anthocyanin colouration	Tan
3.	Leaf	Midrib colour of the 5 <sup>th</sup> leaf	Dull white
4.	Plant	Time of panicle emergence	Early (55 days)
5.	Plant	Total height (at Maturity)	High (225-240 cm)
6.	Flag leaf	Yellow colouration of the midrib	Absent
7.	Flag leaf	Extension of discolouration of the midrib	Medium
8.	Glume	Anthocyanin colouration of the pubescence	Absent
9.	Lemma	Arista formation	Absent
10.	Stigma	Anthocyanin	Absent
11.	Stigma	Yellow colouration	Absent
12.	Stigma	Length	Medium
13.	Flower with Pedicel	Length of the flower	Medium
14.	Anther	Colour of the dry anther	Orange
15.	Anther	Length (at flowering)	Medium
16.	Stem	Stem diameter (at maturity)	Medium (1.8 to 2.6 cm)
17.	Stem	Stalk juiciness	Juicy
18.	Stem	Stalk sweetness	Sugary
19.	Leaf	Length of the blade (3 <sup>rd</sup> leaf from top)	Long (76 to 82 cm)
20.	Leaf	Width of the blade (3 <sup>rd</sup> leaf from top)	Narrow (6.5 to 8.0 cm)
21.	Peduncle	Exertion	Exertion 10.0 to 15.0 cm
22.	Panicle	Length	Medium (25 to 30 cm)
23.	Panicle	Length of the branches (middle panicle)	Long (8.0 to 10.0 cm)
24.	Panicle	Density at maturity	Semi compact
25.	Panicle	Shape	Elongate
26.	Panicle	Length of the neck visible above sheath	Medium (8.0 to 12.0 cm)
27.	Glume	The colour at Physiological Maturity	Straw
28.	Glume	Length	Medium (40% of Grain)
29.	Grain	Caryopsis colour after threshing	Creamy White
30.	Grain	1000-grain weight	Medium (28.8 g)
31.	Grain	Shape in dorsal view	Spherical
32.	Grain	Shape in profile view	Spherical
33.	Grain	Texture of endosperm	Half vitreous
34.	Grain	Luster	Lustrous
35.	Duration	Day to Flowering	60 days (early)
36.	Duration	Day to Maturity	95 days (early)
37.	Yield	Single plant seed yield (g/plant)	40 g
38.	Yield	Dry fodder yield (g/ plant)	102 g

2827 and 2234 kg/ha by the checks K 8 and CSV 17 respectively. The grain yield was 23.2 and 59.8 per cent increased over the check variety K 8 and CSV 17 respectively. Mean dry fodder yield of TKS 0809 was 13.92 t/ha as against 10.12 and 7.81 t/ha which was 37.5 and 78.2 per cent increased fodder yield over the checks K 8 and CSV 17 respectively.

The Multi-location trial was conducted at 30 locations over different seasons and years (16 locations in Kharif season over 3 years (2009-12), 9 locations in Rabi season over three years (2009-12) and 5 locations in summer season during 2010 under rainfed vertisol tracts of Tamil Nadu. TKS 0809 recorded an average grain yield of 2886 kg/ha which was 14.1 and 14.5 per cent increased yield over

the checks K 8 and CSV 17 respectively. TKS 0809 also recorded higher dry fodder yield of 11.32 t/ha which is 48% increase over K 8 (7.65 t/ha) and 78.8% over CSV 17 (6.33 t/ha).

In All India Co-ordinated Sorghum Improvement Project trial TKS 0809 was evaluated in three locations at the national level in the name of SPV 2084 during late Kharif and Rabi (2010-11). The culture TKS 0809 has recorded an average grain yield of 4037 kg/ha which was 37.8 per cent increased yield over the national check CSV 17. It also registered high dry fodder yield of 4.27 t/ha which was 25.3 per cent increased yield over the national check CSV 17 (Table 1).

**Table 1. Performance of sorghum culture TKS 0809 in AICSIP trials late Kharif (2010 - 11)**

Entries	Grain yield kg/ha				Dry fodder yield t/ha			
	Kovilan-gulam	Kovil patti	Nandyal	All India Average	Kovilan gulam	Kovil patti	Nandyal	All India Average
SPV 2084 (TKSV 0809)	2626	4474	3600	4037	4.76	14.51	3.78	4.27
CSV 17 (c)	1782	2792	3068	2930	3.40	8.86	3.42	3.4
% increase over CSV 17 (c)	<b>37.8</b>				<b>25.3</b>			

In Adaptive Research Trials (ART) conducted at 79 location during Rabi 2011-12 revealed that the sorghum culture TKS 0809 recorded 3091 kg/ha which is 10.4 % increased yield over K 8 (2801 kg/ha) (Table 2). Similarly,

in OFT (Rabi 2012-13) conducted in 58 locations this culture registered superior grain yield of 2743 kg/ha which is 22.7% increased yield over the best check K 8 (3138 kg/ha).

**Table 2. Performance of sorghum culture TKS 0809 in adaptive research trial (2011-12)**

Sl. No.	Name of the district	No. of Location	Grain yield (kg/ha)			Dry fodder yield t/ha		
			TKSV 0809	K 8 (c)	CSV 17 (c)	TKSV 0809	K 8 (c)	CSV 17 (c)
1.	Thoothukudi	10	2748	2582	2584	11.38	9.94	10.12
2.	Ramanathapuram	8	2721	2332	2230	-	-	-
3.	Virudhunagar	5	2852	2821	2720	11.0	9.0	7.0
4.	Tirunelveli	10	3616	3269	3382	-	-	-
5.	Sivagangai	10	2921	2415	2602	-	-	-
6.	Madurai	9	3156	2587	2437	7.84	7.35	7.27
7.	Pudukottai	7	3864	3773	3784	-	-	-
8.	Dindigul	10	3324	2850	2391	10.0	8.0	7.0
9.	Theni	10	3014	2304	2226	12.3	6.5	9.5
	Overall mean	<b>79</b>	<b>3091</b>	<b>2801</b>	<b>2680</b>	<b>10.7</b>	<b>8.2</b>	<b>8.4</b>
	% Increase over K 8(c)		<b>10.4</b>	-	-	<b>30.5</b>	-	-
	% Increase over CSV 17(c)		<b>15.3</b>	-	-	<b>27.4</b>	-	-

Overall performance and its adaptability to different agro-climatic regions of the state are the basic criteria for release of any variety in a state. The culture TKS 0809 recorded the average grain yield of 3123 kg/ha over 185 locations from different yield trials viz., Station trials, Multi-location trials, ART/ OFT and All India Co-ordinated trials. The yield increase of grain yield for TKS 0809

(3123 kg/ha) is 22.4 and 23.9 per cent over the checks K 8 (2569 kg/ha) and CSV 17 (2579 kg/ha) respectively (Table 3). This culture registered maximum grain yield potential of 6519 kg/ha in the summer irrigated condition at Ayikudi, Tenkasi region as compared to the check K 8 (2296 kg/ha), which is 183.9 per cent increased yield over the check K 8.

**Table 3. Overall Mean performance of TKS V 0809 culture for grain yield under different yield trials**

Sl. No.	Trials	No. of trials	Mean grain yield kg/ha			% increase over check	
			TKSV 0809	K 8 (c)	CSV 17 (c)	K 8 (c)	CSV 17 (c)
1.	Station trials	5	3570	2897	2234	23.2	59.8
2.	Multi-location trials	30	2886	2530	2521	14.1	14.5
3.	All India Co-ordinated trial	3	4037	3167	2930	27.5	37.8
4.	ART trials	79	3091	2801	2680	10.4	15.3
5.	OFT trials (KVK)	58	2743	2235	1961	22.7	39.9
6.	OFT trials (SI)	10	5801	2457	5610	139.3	5.2
	<b>Mean</b>	<b>185</b>	<b>3123</b>	<b>2569</b>	<b>2579</b>	<b>22.4</b>	<b>23.9</b>

Sorghum is often grown for its dry fodder apart from grain to sustain a large population of animals in Tamil Nadu. Sorghum variety without dry fodder yield has no value in southern peninsular India. Considering the overall

performance of the dry fodder yield the culture TKS V 0809 exhibited superiority of 11.9 t/ha, which was 31.8 and 40.7 per cent increased yield over the checks K 8 (9.2 t/ha) and CSV 17 (8.5 t/ha) (Table 4).

**Table 4. Overall Mean performance of TKS V 0809 culture for dry fodder yield under different yield trials**

Sl. No.	Trials	No. of trials	Mean dry fodder yield t/ha			% increase over check	
			TKSV 0809	K 8 (c)	CSV 17 (c)	K 8 (c)	CSV 17 (c)
1.	Station trials	5	13.92	10.12	7.81	37.5	78.2
2.	Multilocation trials	2	11.32	7.65	6.33	48.0	78.8
3.	All India Co-ordinated trial	3	4.27	4.25	3.41	1.0	25.2
4.	ART trials	44	10.7	8.2	8.4	30.5	27.4
5.	OFT trials (KVK)	53	12.3	9.0	8.3	36.7	48.2
6.	OFT trials (SI)	10	16.9	15.9	12.8	15.5	38.5
	<b>Mean</b>	<b>117</b>	<b>11.9</b>	<b>9.2</b>	<b>8.5</b>	<b>31.8</b>	<b>40.7</b>

Sorghum production is greatly affected by a variety of insect pests and disease. The sorghum culture TKS V 0809 was screened against major pests and diseases along with checks (Table 5). The culture TKS V 0809

exhibited moderate resistance to shoot fly and stem borer as compared to checks. Besides the culture of TKS V 0809 was founded to be resistant to downy mildew and leaf spot diseases. (Table 6)

**Table 5. The reaction of sorghum culture TKS V 0809 to pest incidence**

Sl. No.	Entries	Shootfly deadhearts 21 DAE	Shootfly deadhearts 28 DAE	Stemborer deadhearts on 45 DAE	Stemborer leaf injury on 45 DAE rating 1-9 scale
1.	TKSV 0809	13.8	27.8	18.5	2.6
2.	K 8 (c)	17.0	22.0	34.9	3.0
3.	CSV 17 (c)	12.0	16.4	18.0	2.0
4.	Co S 28 (c)	19.6	29.1	25.8	3.3
5.	Co 30 (c)	18.9	26.4	25.1	3.2

**Table 6. The reaction of sorghum culture TKS V 0809 to different diseases**

Sl. No.	Entries	Downy mildew	Rust (1-9)	Grey leaf spot (1-9)	Anthraco nose (1-9)
1.	TKSV 0809	1.46 (R)	0.20 (R)	1.06 (R)	0
2.	K 8 (c)	2.21 (R)	0.30 (R)	2.82 (R)	0
3.	CSV 17 (c)	1.89 (R)	0.26 (R)	2.52 (R)	0

The nutritional status of the grain revealed that the sorghum culture, TKS<sub>V</sub> 0809 had superior nutritive qualities for protein (9.58%) over checks K 8 (8.71%) and CSV 17 (8.03) (Table 7).

**Table 7. Nutritional quality of grains and fodder of sorghum variety K 12**

Sl. No.	Sorghum grain	Crude protein (%)	Crude fibre (%)	Ether extract (%)	Calcium (%)	Phosphorus (%)	Iron (ppm)
1.	TKSV 0809	9.58	1.17	3.46	0.35	0.29	106.60
2.	K 8 (c)	8.71	1.32	3.15	0.30	0.18	63.03
3.	CSV 17 (c)	8.03	1.05	3.06	0.35	0.31	108.32

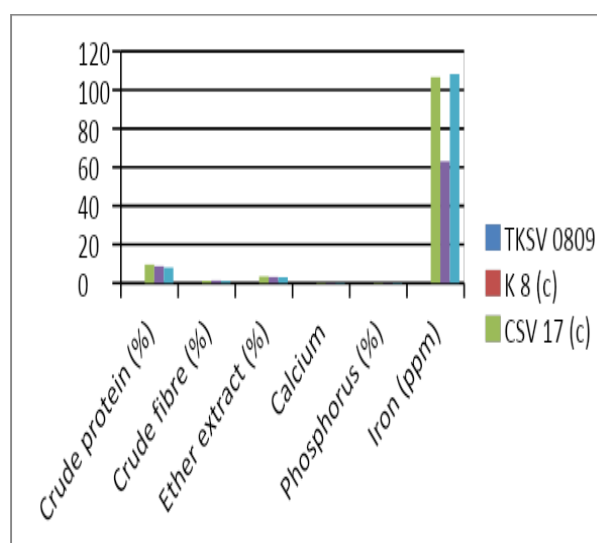
Similarly, the dry fodder samples of TKS<sub>V</sub> 0809 has revealed high protein content (6.55%) and crude fibre digestibility (53.3%) compared to the checks K 8 (48.3%) and CSV 17 (49.2%). Identification of superior dual-purpose (Food and fodder) sorghum variety is the need of the hour as it is the only way to meet the demand for food, feed and fodder of the country (Blummel and Reddy, 2006).

Besides high grain yield and the fodder yield it is photo insensitive variety suitable for growing in all-season where it is a deficit in K 8. This culture is a medium-tall variety with a plant height of 225 to 240 cm and also found non-lodging. Since it is a short duration variety matures in 95 - 100 days it escapes from terminal drought if occur in North-East monsoon. The grain colour is a creamy white colour and highly acceptable quality. It has a semi-compact cylindrical head covered with 1/3<sup>rd</sup> of glume. The dry fodder is highly acceptable with high dry matter digestibility (53.3%) over K 8 (48.4%). The average dry fodder yield is 11.9 t/ha.

Since the sorghum culture of TKS<sub>V</sub> 0809 exhibited superiority in grain and fodder yield and its nutritional

## REFERENCES

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qualities over the checks K 8 and CSV 17 under both rainfed ecosystems and in summer irrigated condition the sorghum culture was released as K 12 sorghum for commercial cultivation in Southern districts of Tamil Nadu.