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A Dual Purpose Promising Kharif Sorghum Hybrid for Zone 8 of Karnataka

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Abstract : A dual purpose Dharwad Sorghum Hybrid 3 (DSH 3) was tested from 1990 to 1995 for its stablised performance. It yields 25 % higher grain and 75% fodder than CSH 5. It is a tall, quick growing, stay green, tan type dual purpose hybrid. It has more leaf area index and does not lodge in strong winds. It is photosynthetically much efficient than CSH 5 as indicated by high photosynthetic rate and dry matter accumulation. Its tolerane capacity to pests and diseases is better than CSH 5. It matures at 13O days. Thus it can replace CSH 5 in transitional tract (Zone 8) of Karnataka.

Introduction

Sorghum is a major source of food for millions of people in the semi arid tropic&. Sorghum grain is also used as feed for live stocks and poultry. The stem and foliage are used as green fodder, hay, silage and pasture. The stems are also used as fuel and building material . Owing to its multiple uses, every farmer in northern Karnataka grows sorghum to meet his family and livestock requirements.Introduction of high yielding but dwarf hybrids, developed by utilizing exotic material during 1960s helped the sorghum growers to increase grain production by three folds. Unfortunately all these hybrids were producing low quantity and bad quality fodder due to their dwarf stature and susceptible to pests and diseases (Borikar and Chopde 1981). Thus farmers who need to maintain livestock were unable to meet fodder requirement of their cattle by adoption of these high yielding but dwarf hybrids. Hence farmers shifted back to their local varieties which are tall and high fodder yielders but poor grain yielders and are still popualr with the farmers of zone 8. Grain production is also stagnated since 1980. Tall, quick growing, photosynthetically efficient dual purpose hybrids can further increase both food and fodder production. Efforts were, therefore, initiated at Sorghum Improvement Project,MRS Dharwad to evolve high yielding dual purpose Kharif sorghum hybrids.

Material and Methods

Several, cross combinations were effected by using diverse male sterile and restorer lines to evolve tall hybrids which can produce increased grain and fodder yields than existing hybrids and local varieties respectively. Among these combinations, a cross combination of SB 401A X SB 7001 was found to be very much promising in all respects. Both parents of this hybrids SB 401A and SB 7001 were developed

from this centre and are tan types. This combination, here after called as DSH 3 was evaluated for its stabilised performance over six seasons from 1990 to 1995. Field experiments were conducted at the Main Research Station, Dharwad and Agricultural Research Station, Bailhongal to evaluate its grain and fodder yielding ability. This hybrid along with other six promising hybrids and popular hybrid CSH 5 was evaluated in randomised block design with three replications during all the six years. Each entry was sown in a plot size of 2.7 X 5 m^2 with a spacing of 45 X 15 cm. All the recommended agronomic practices for hybrids were followed.

Similarly another experiment with same entries and experimental design was conducted during 1996 kharif season to assess the possible physiological reasons for the increased yield of DSH 3 over popular hybrid CSH 5. The trial was conducted with three replication, and five randomly selected plants per replication were used for recording observations. Physiological parameters like dry matter accumulation in leaf, stem, ear head; leaf area index and photsynthetic rate were studied at three stages viz., 30 days after sowing, flowering and at maturity were studied by using IRGA.

In order to assess the ratoonability of these hybrids, the same experiment was continued in rabi season after harvest of kharif main crop. The stalks of all the entries were cut uniformly at six cm above the ground level and allowed for ratooning. The fertilizers at the rate of 50 kg N per ha. and 25 kg P per ha. were applied and other agronomic practices like weeding and interculturing were followed to raise a good ratoon crop. The grain and fodder yields were recorded from the ratoon crop.

DSH 3 was also evaluated for its reaction to pests and diseases in comparison with CSH 5 in pest and diesase nursery trial separately by following standard proceedures for two years (Taneja and Leushner, 1985; Sharma *et al.*, 1992 and Anahosur, 1987). The observations on incidences of shoot fly, stem borer, midge, earhead bug, sorghum downy mildew and rust were recorded at appropriate times by using standards scoring scales.

DSH 3 was also tested in 14 farm trials during 1995 and 1996 in Dharwad and Belgaum districts to establish its feasibility and adaptability in farmers field conditions.

Results and Discussion

Hybrids differed significantly both for grain and fodder yield at Dharwad during all the years of test (Table-1). The grain yield levels of DSH 3 varied from 43 quintals/ha in 1991 to 72 per/ha in 1995. Whereas, check CSH 5 varied from 33 to 60 qtls/ha. DSH 3 has significantly out yielded CSH 5 during all years of test except 1991 and 1993. On an average of six years the hybrid has recorded 59 q/ha as against 47 q/ha of popular hybrid CSH 5 indicating 27 per cent superiority of DSH 3 over CSH 5. Whereas in fodder yield it has significantly out yielded CSH 5 during all the years. The fodder levels of DSH 3 varied from 141 t/ha in 1992 to 22 t/ha in 1995 while that of CSH 5 varied from 4 to 14 t/ha. The mean fodder yield of DSH 3 was 15 t/ha compared to 9 t/ha of check CSH 5 indicating 77% higher fodder yield of DSH 3 over CSH 5. The results of this experiment clearly indicate superiority of DSH 3 for grain and fodder yield over CSH 5.

Eventhough grain yield levels were low at Bailhongal centre, per cent increase in grain

Table 1. Performance of DSH 3 at Dharwad over seasons

	Grain yield (q/ha)								Dry fodder yield (t/ha)							
Year	1990	1991	1992	1993	1994	1995	Av.	% incr.	1990	1991	1992	1993	1994	1995	Av.	% incr.
DSH 3	65	43	51	61	61	72	59	27	15	15	11	15	15	22	15	76
CSH 5	33	44	39	58	46	60	47	-	13	6	4	9	8	14	9	-
CD 5%	12	16	7	10	12	11	-	-	1.1	3.4	1.1	2.2	1.3	2.3	-	-
CV %	17	13	8	9	15	9	-	-	9	22	8	13	9	9	-	-

Table 2. Performance of DSH 3 at Bailhongal (Grain yield q/ha)

	Grain yield (q/ha)					
Year	1991	1993	1994	1995	Av.	% incr.
SHD 9201	54	24	19	31	32	23
CSH 5	41	28	17	17	26	-
CD 5%	14	12	7	7	-	-
CV %	20	22	21	15	-	-

yield of DSH 3 maintained at almost constant level by recording 23 per cent increased yield (Table 2). Similarly at farmers field conditions also It maintained its increased yielding ability over CSH 5 at the same level (Table 3). On an average of 14 locations on the farmers fields of Belgaum and Dharwad districts DSH 3 has recorded 25 per cent higher grain yield over CSH 5 during 1995 while 19 per cent during 1996.

Thus, the hybrid performed constantly better than C3H 5 across several seasons and locations in research experiments as well as in farmers fields. This proves Its highly stabilised performance. Hence it can be concluded that Dharwad Sorghum Hybrid 3 (DSH 3) is most promising and boon to farmers of zone 8 of Karnataka as it yields 25 per cent higher grain and 75 per cent higher fodder than popular hybrid CSH 6, thus meets both food and fodder needs. The physiological investigations revealed that dry matter accumulation of DSH 3 in leaf, stem and ear head at flowering stage was 21.1 g/pl,

Table 3. Performance of DSH 3 in farm trials (Grain yield in q/ha)

	No. of trials	1995-96		1996-97	
District		DSH 3	CSH 5	DSH 3	CSH 5
Belgaum	5	20	20	29	25
Dharwad	5	17	14	20	16
EEU, Dharwad	4	38	27	38	33
Zonal Mean	-	25	20	29	25
% increase	-	25%	-	19%	-

52.9 g/pl and 9.3g/pl respectively. While the same was 12.0 g/pl, 29.4g/pl and 7.7 g/pl in CSH 5 (Table 4). The results clearly Indicated that the dry matter accumulation was significantly higher in DSH 3 compared to CSH 5.The dry matter acumulation at 30th day also clearly indicate the superiority of DSH 3 over CSH 5. Thus the new hybrid produces higher grain and fodder yield due its fast growth from intial stages itself which was also supported by higher leaf area index (7.49) and higher photosynthetic rate 27.5 μ mol/m^2 /h of DSH 3 compared to CSH 5 (5.30 ; 23.6 μ mol/m^2/h). Such higher dry matter, photosynthetic rate and leaf area index in high yielding genotypes was reported in sorghum and several crop species (Hiremath, et al., 1994 and Konda *et al.*, 1996). From these physiological investigations, we can conclude that DSH 3 yields higher grain and fodder than CSH 5 due its inherant capacity to grow fast by accumulating more dry matter since germination. This higher dry matter production may be due to higher photosynthetic efficiency and higher leaf area index of DSH 3 over CSH 5. It is also interesting to note that per day yield of DSH 3 (433 g/day/ ha) was considersably higher compared to CSH 5 (324 g/day/ha) although DSH 3 matures late by 10 days. The high yield of DSH 3 is also due to longer GS 3 stage and late senesence of leaves in this stage (Wilson and Eastin,

Table 4. Physiological investigations on DSH-3

Entry	Days to flower	Dry matter production at 30 DAS			Dry matter production at flowering				LAI (q/ha)	Gr.Yd. grain	1000 µ mol/ weight g	Pht. grain m^2/hr	Ratoon yield (q/ha)
		Leaf	Stem	Total	Leaf	Stem	Earhead	Total					
DSH 3	73	3.2	1.3	4.5	21	53	9	83	7.5	66	29.0	27.5	24
CSH 5	67	2.6	0.9	3.4	13	29	8	50	5.3	39	22.2	23.6	18

Table 5. Reaction to pests and disease (average of two years)

Entry	SF%	SB%	Mid%	EHB %	SDM%	Rust (0-5)	ZLS (0-5)	Anthracnose
DSH 3	34	28	26	1.1	2.4	2	2	2
CSH 5	35	34	42	3.0	4.5	5	3	3

1982).Higher test weight of DSH 3 grains (29.0 g/1000 seeds)has also contributed to increase in yield over CSH 5 (22.2 g).

The Ratoon grain yield of DSH 3 was 24 q/ha compared to 18 q/ha of CSH 5 (Table 4). DSH 3 recorded significantly higher grain yield over CSH 5 even under ratooning. The average ratoon yield of DSH 3 was more or less on par with the main rabi crop yields suggesting that DSH 3 may be grown as ratoon crop. The reaction of DSH 3 and CSH 5 to pest and diseases indicated the superiority of DSH 3 over CSH 5 for most of the pests and disesases (Table 5). DSH 3 reocrded better tolerance to stem borer, midge and earhead bug compared to CSH 5, while for shootfly tolerance, it was on par with CQ-H 5. Similarly, it has recorded significantly lower incidence of downy mildew, rust, zonate leaf spot and anthracnose compared to CSH 5. DSH 3 showed lower susceptibility to pest and dieases compared to CSH 5.

All these above experiments proved the superiority of DSH 3 over CSH 5 for stabilized yields, resistance to diseases, photosynthetic efficiency and ratoonability. DSH 3 is a tall and quick growing dual purpose hybrid, which has more number of broad leaves and remain green even at physiological maturity. It has cylindrical, semi compact earbead, and has bolder seeds than CSH 5. Roti quality is comparable with CSH 5. It responds well to fertilizers and irrigation. Technology recommended for other also except sufficient hybrids holds good for this hybrid also except sufficient moisture is needed for this hybrid owing to its late maturity by ten days. Looking to all these aspects of DSH 3, University of Agricultural Sciences has recommended this hybrid for release.

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