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NEW HYBRIDS AND VARIETIES OF SORGHUM AND THEIR PERFORMANCE[1]

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ABSTRACT

The performance of some of the recently developed hybrids and varieties during the *kharif* season in India over a three year period has been examined. The recently released hybrid SPH-61 (CSH-9) was consistently superior and the most stable in yield performance. Hybrids were generally superior in performance and stability compared to improved varieties, but the latter do reflect significant improvement over local cultivars and could supplement hybrids to accomplish greater coverage.

SORGHUM breeding programmes in India continue to lay emphasis on the development of high yielding varieties and hybrids. There is also emphasis on similar maturity of hybrids and varieties so that earhead pest problems like midge resulting from growing cultivars of dissimilar maturities in a given tract are not accentuated (Rao and Jotwani, 1974). The present study attempts to analyse the three-year performance of some promising hybrids and varieties which reflect recent improvements in the development of hybrids and varieties.

MATERIALS AND METHODS

The experimental material for the present study comprised four early maturing varieties (SPV-35, SPV-96, SPV-99, and CSV-3) and two hybrids (CSH-1 and CSH-6) grown in the early maturity trial at a number of locations. A second All-India trial included medium maturity varieties (SPV-97, SPV-102, SPV-104, SPV-105, SPV-106 and SPV-107) and two hybrids (CSH-5 and SPH-61). Data on both trials was available over the three year period, 1976, 1977 and 1978. The total number of test locations over this period were III for hybrids, 113 for early maturing varieties and 118 for medium duration varieties. All the varieties were derived from tropical × temperate crosses. In case of CSH-1, CSH-5 and CSH-6 there is some tropical 'blood' in the male parents while in case of SPH-61 both parents have tropical × temperate parentage. The early hybrids and varieties matured in 90–100 days while the medium ones took 105–115 days to mature. Replicated trials were grown under rainfed conditions in the different agroclimatic regions of the country with standard cultural practices. The net plot size was 13·5 sq. metres. Stability analyses were done separately for each entry following Eberhart and Russell (1966).

RESULTS

YIELD POTENTIAL OF IMPROVED HYBRIDS AND VARIETIES

The comparative yields of the experimental hybrid, SPH-61 (now recommended for release as CSH-9), released hybrids and some of the new promising varieties are presented in Table 1. SPH-61 yielded 3379 kg to 4718 kg grain per

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TABLE 1

Average grain yield performance of hybrids and varieties (kharif 1976–78) *over* 111 *to* 118 *locactions all over India*

Hybrid/Variety		GRAIN YIELD (kg/ha)							Average
		Maha-rashtra	Karna-taka	Tamil-nadu	Andhra Pradesh	Madhya Pradesh	Gujarat	Rajasthan	
				A. Hybrids					
CSH-1	Av.	3960.5	3852.6	3729.2	2892.9	2627.5	2249.3	3077.0	3357.6
	% CSH-5	112.5	102.8	95.0	87.5	78.7	79.9	102.9	92.6
CSH-6	Av.	4193.0	4429.3	4180.4	3246.8	2974.0	2621.2	3591.1	3711.1
	% CSH-5	119.1	118.1	106.4	98.2	89.1	93.1	120.1	102.4
CSH-5	Av.	3519.5	3749.3	3927.3	3305.2	3338.1	2816.7	2988.7	3624.4
SPH-61	Av.	4717.7	4509.9	4250.4	3379.4	3563.5	3763.7	4454.6	4232.2
(CSH-9)	% CSH-5	134.0	120.3	108.2	102.2	106.7	133.6	149.0	116.8
				B. Varieties (Early Maturing)					
SPV-35	Av.	3605.5	3747.4	2773.7	2550.3	2287.3	1976.2	2539.1	3007.0
	% Local	166.3	194.6	150.5	136.3	115.7	83.8	211.4	151.4
SPV-96	Av.	3088.6	2797.0	2120.5	2248.9	2156.0	1567.5	2442.8	2530.8
	% Local	142.4	145.2	115.1	120.2	109.0	66.5	203.3	127.5
SPV-99	Av.	2931.1	2924.9	2145.0	2329.3	1936.6	2078.5	2325.2	2529.5
	% Local	135.2	151.9	116.4	124.5	97.9	88.1	193.5	127.4
CSV-3	Av.	3470.7	2968.5	2595.8	2168.4	2900.2	2336.0	2691.9	2894.5
	% Local	160.1	154.1	140.9	115.9	146.7	99.0	224.1	145.8
				C. Varieties (Medium Duration)					
SPV-102	Av.	3260.2	2804.3	2367.3	1941.1	2029.7	2431.8	2270.3	2639.0
	% Local	150.4	145.6	128.5	103.7	102.6	103.1	189.0	132.9
SPV-104	Av.	3186.5	2937.8	2322.9	2050.9	2080.0	2421.2	2917.7	2699.7
	% Local	146.9	152.5	126.1	109.6	105.2	102.7	242.9	136.0
SPV-107	Av.	3453.2	3014.5	2324.5	2350.5	2450.7	2511.3	3593.9	2979.5
	% Local	159.3	156.5	126.2	125.6	123.9	106.5	299.1	150.1
Local	Av.	2168.3	1926.1	1842.6	1871.1	1977.6	2358.7	1201.4	1985·7

hectare and excelled all the released hybrids in each State. It showed an average superiority of 17% over CSH-5, 14% over CSH-6 and 26% over CSH-1.

Experimental varieties SPV nos. 102, 104 and 107 produced 33 to 50% more grain yield than local cultivars. SPV-102 and SPV-104 were particularly superior in Maharashtra, Karnataka, Tamilnadu and Rajasthan States but SPV-107 was consistently superior in all the States.

Early maturing varieties, CSV-3, SPV-35, SPV-96 and SPV-99 were 27–51% high yielding than locals. CSV-3 and SPV-35 were the highest yielders among them. Greater advantage of improved early and mid-late varieties was observed in Rajasthan followed by Karnataka and Maharashtra. However, only mid-late hybrids/varieties appeared to be advantageous in Gujarat and Madhya Pradesh.

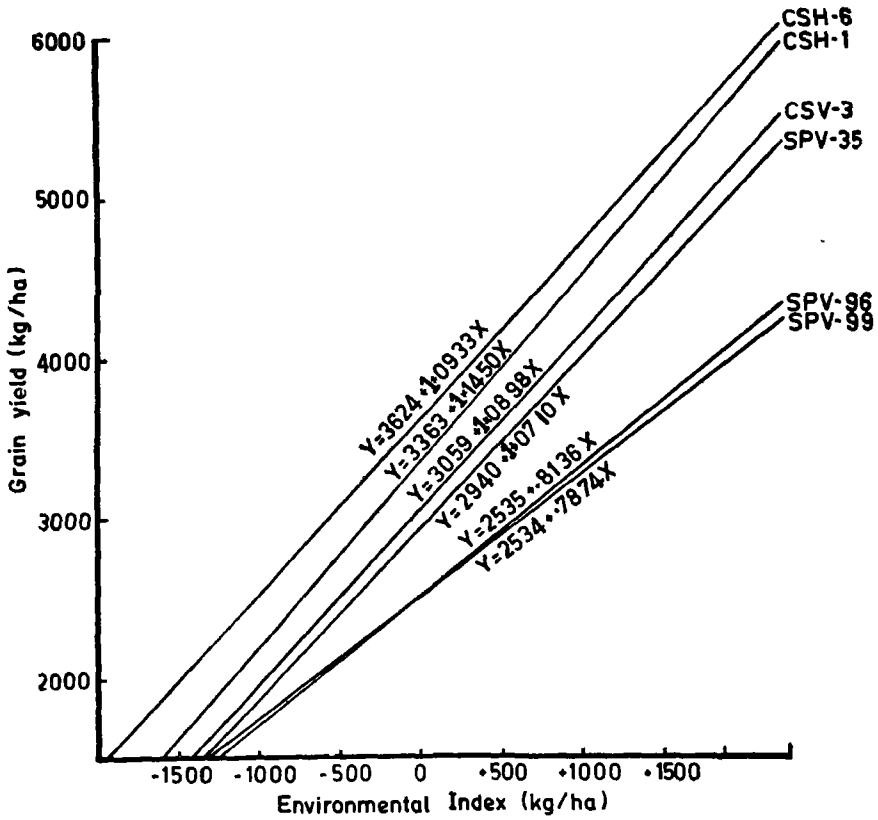

FIG. 1. Stability of early hybrids and varieties

Comparative yield performance of B lines (counter parts of females of hybrids used in the study) showed that 296B, the female parent of SPH-61 out-yielded all the female parents of released hybrids. Averaged over the three

year period and over 25–27 locations, the grain yields of B lines were 296B (3074 kg/ha), 2077B (1897 kg/ha), 2219B (2686 kg/ha), and CK60B (2757 kg/ha). Since the male parent of CSH-5, CSH-6 and SPH-61 was the same, grain yield superiority of SPH-61 was mainly attributed to high yielding potential of its female parent and its combining ability with CS 3541.

STABILITY OF PERFORMANCE OF HYBRIDS AND VARIETIES

Among the early entries, CSH-6 was the highest yielding hybrid with slope slightly above unity (Fig. 1). CSH-1 was the next best in stability of performance. CSV-3 and SPV-35 showed average stability while SPV-96 and SPV-99 were relatively low yielding in this group but less sensitive to stress or improvement in environment.

Stability anlaysis of medium duration hybrids and varieties indicated that SPH-61 was superior to CSH-5 and other hybrids/varieties with respect to yield

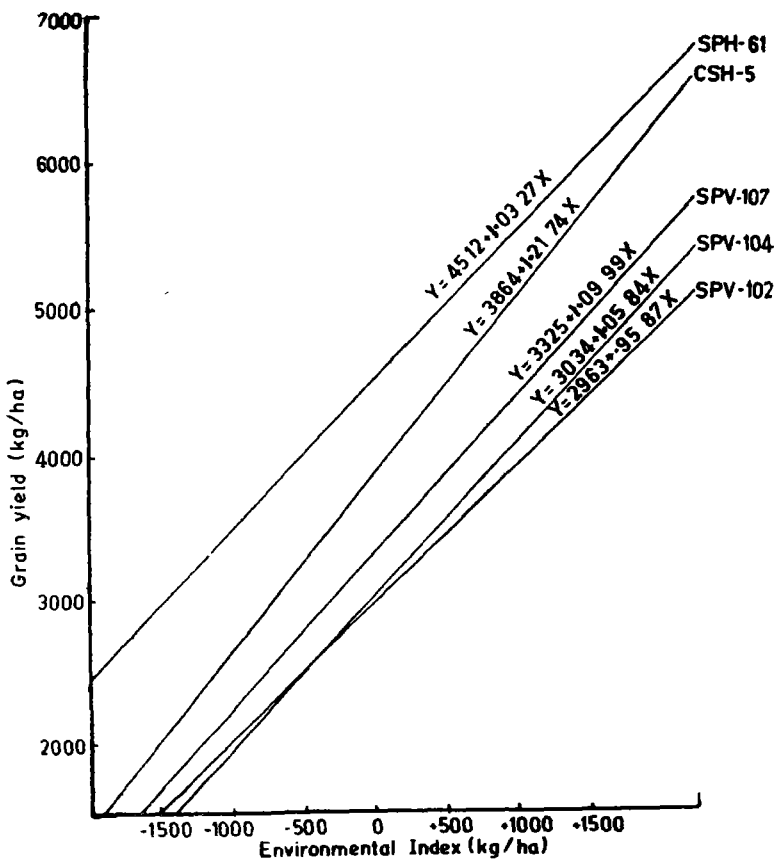

FIG. 2. Stability of medium duration hybrids and varieties

levels as well as stability both in poor and advantageous environmental conditions (Fig. 2). Yield of early hybrids, CSH-1 and CSH-6 was comparatively lower than mid-late hybrids. Deviations from linearity were particularly low in case of CSH-6. Among varieties, SPV-107, SPV-104, SPV-102 and SPV-101 were high yielding with slopes close to 1·0 (Fig. 2). Deviations from linearity were considerably low in case of SPV-104 and SPV-107. SPH-61 was the most widely adaptable hybrid. It was characterised by highest mean yield and low C.V. computed over all the locations during three years period (Fig. 3). CSH-5 and CSH-6 were the next best in their adaptability. CSV-3, CSH-1 and SPV-107 were intermediate in yield performance but reasonably good in their adaptability. Improved varieties such as CSV-4, SPV-102 and SPV-104 were intermediate in yield potential and adaptability. The performance of locals was characterised by low mean and high C.V. suggesting their poor and unstable performance.

COMPARATIVE PERFORMANCE OF HYBRIDS VS VARIETIES

Average grain yields and stability parameters of promising varieties and hybrids grown in the same trials are presented in Table 2. Difference between yield performance of early varieties *vs.* hybrids was highly significant, hybrids being more productive than varieties and more adaptable ($b > 1 \cdot 1$). Similarly, mid-late hybrids possessed much higher yield potential over mid-late varieties, however, stability parameters were similar ($b = 1 \cdot 0$).

TABLE 2

Average grain yields (kg/ha) and stability of performance of some promising hybrids and varieties

Group	VARIETY		HYBRID		
	Mean	b	Mean	% over var.	b
Early	2767	0.9404	3493.5	26.12	1.1192
Mid	2822	1.0072	3994.5	41.62	0.9677

Significant at 1%; M.S. (Var. × Hyb.) Early group=37.2; Mid group 4.1**.

Advantage of mid-late hybrids over varieties of corresponding maturity was more (41·6%) than the advantage of early hybrids over early varieties. Comparison between the two maturity groups indicated that mid-late varieties were not appreciably superior in yield and stability over early varieties. Delayed maturity in hybrids conferred 14·3% advantage in grain yield over early duration hybrids.

Discussion

Development of high yielding hybrids and varieties of sorghum has made rapid strides in India during the recent past. The development of parents for new hybrids and varieties involved the use of exotic × Indian (temperate × tropical) crosses.

Both male and female parents of SPH-61 (CSH-9), the recently released hybrid are of exotic × Indian parentage and apparently the female improvement was responsible for its superiority since the male parent was common to CSH-5, CSH-6 and CSH-9. The results also indicate that superior yields and stability of performance seem to go together in most cases, since SPH-61 (CSH-9) was not only the highest yielder but most stable among all hybrids. That hybrids continue to be still superior to improved varieties with respect to performance and stability, as observed before (Rao and Harinarayana, 1968; Singhania and Rao, 1976) is also borne out in the present study. Amongst the varieties, the performance of SPV-35 among earlies and SPV-102, SPV-104 and SPV-107 among medium duration types is encouraging. Since their maturity is similar to the hybrids of the respective groups, and they are superior to locals, they could supplement hybrids to accomplish greater coverages and minimise damage due to earhead pests like midge occurring on late locals. The hybrids have higher yield levels and low C.V. compared to the improved varieties but the latter do reflect significant improvement over the local cultivars (Fig. 3).

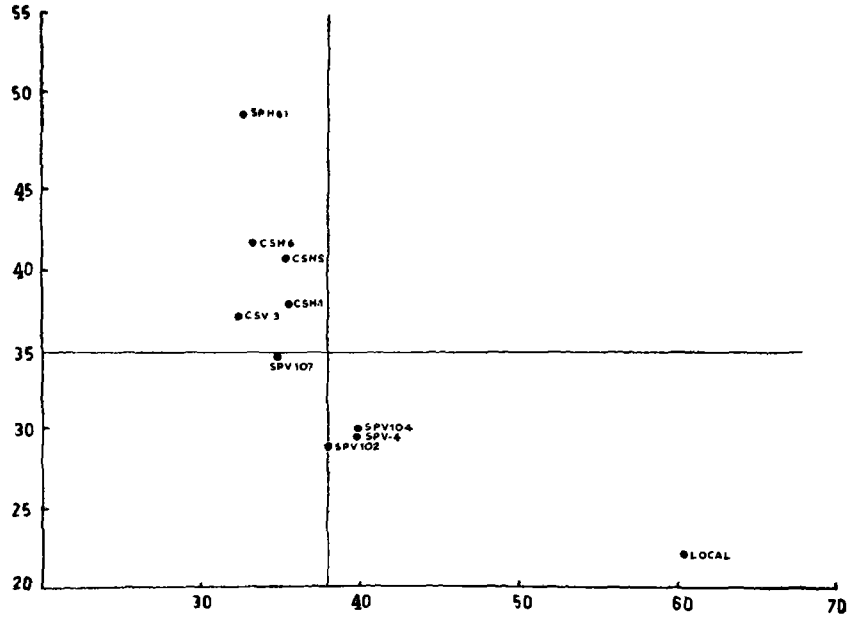

Fig. 3. Adaptability of promising sorghum hybrids and varieties; X—axis= Coefficient of variability and Y—axis=Grain yield (Q/ha).

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