



Effect of planting ratios on crop growth, flowering parameters and seed yield of sorghum hybrid cv-SHD-9704

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Abstract : The present investigation was undertaken during 2007 and 2008 at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *Rabi* season in 2007-08 and *Kharif* season in 2008 and their pooled data on effect of planting ratios on crop growth, flowering parameters and seed yield on sorghum hybrid cv-SHD-9704 . The 6:2 planting ratio (P_2) recorded numerically more (106.58 cm) plant height at harvest, number of leaves (9.53) at 75 DAS, days to crop maturity (93.84 days), days to primordial initiation (37.64 days) and 50 per cent flowering (69.04 days) compared to 4:2 planting ratios (P_1) (101.01 cm, 9.22, 90.71 days, 35.83 days and 66.88 days, respectively). Whereas, leaf area and leaf area index at 75 DAS numerically were more (3068 cm² and 4.54, respectively) in 4:2 planting ratio (P_1) than 6:2 planting ratio (P_2) (2968 cm² and 4.39, respectively). The 4:2 planting ratio (P_1) recorded significantly more ear weight (27.64 g), number of seeds per ear (300.00), seed setting percentage (26.77%), seed weight per ear (10.32 g) and hybrid seed yield per hectare (4.54 q/ha) compared to 6:2 planting ratio (P_2) (23.99 g, 258.00, 23.41%, 8.85 g and 3.96, q/ha, respectively).

Key Words : Sorghum, Planting ratio, Growth, Flowering parameter, Seed yield

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INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] commonly known as 'jowar', is the fifth most important cereal crop in the world next to wheat, rice, maize and barley. It is a staple food crop for more than 300 million people of Asia and Africa continents. India has the largest share (32.50%) of world sorghum area and ranks second in production after USA. In India, it is cultivated on about 7.93 million hectare area with annual production of 7.78 million tonnes and productivity of 981 kg per ha (Anonymous, 2008). The major sorghum growing states in India are Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Rajasthan and Tamil Nadu. In India, Karnataka state is one of the important sorghum growing states and stands second in area and production after Maharashtra. In Karnataka, it accounts for 1.38 million hectare area and production of 1.62 million tonnes with average productivity of 1192 kg per ha (Anonymous, 2009). About 50

per cent of people in Karnataka depend on sorghum as a staple food crop particularly in Northern Karnataka viz., Bijapur, Dharwad, Belgaum, Raichur, Gulbarga, Bellary and Mysore. Hybrid seed production of sorghum crop is influenced largely by several agronomic and management factors, among which planting ratio, staggered sowing and level of nitrogen application are important. The poor seed yield noticed in many sorghum hybrids is mainly attributed to the nicking problem existed between male and female parents. Even in well synchronized plots, the seed yield was found to be far from expectation which may be due to various reasons like wind direction, velocity and availability of insufficient viable pollens to female parent. Therefore, one of the basic requirements in hybrid seed production is to find out optimum planting ratio to provide sufficient quantity of viable pollens to the seed parent during flowering period for ensuring increase pollination and fertilization to obtain higher hybrid seed set and yield. Hence, systematic research works are to be initiated

to find out the effect of planting ratios on the female parental line (AKMS-14A) of new pre-released hybrid sorghum cv SHD-9704 to achieve better synchronization of flowering for higher seed setting and yield of hybrid seed.

MATERIALS AND METHODS

The field experiment was conducted to study the effect of planting ratio on growth, flowering parameters and seed yield in pre-released sorghum hybrid SHD-9704 at the Main Agricultural Research Station, Dharwad Farm, University of Agricultural Sciences, Dharwad during *Rabi* season in 2007-08 and *Kharif* season in 2008. The field experiment consisted of two planting ratios viz., 4:2 and 6:2 (female to male) (Fig. A and B). The foundation seeds of female parent cv. AKMS-14A and male parent cv. SVD-9607 of pre-released sorghum hybrid SHD-9704 were obtained from the Sorghum Breeder, All India Coordinated Sorghum Improvement Project, Main Agricultural Research Station, Dharwad. The observations were made on plant height at harvest, number of leaves, leaf area, leaf area

index at 75 DAS (days after sowing), days to crop maturity, days to flower primordial initiation and 50 per cent flowering, ear weight, number of seeds per ear, seed setting percentage, seed weight per ear, hybrid seed yield per plot and hybrid seed yield per hectare. The data obtained from various periodical observations were subjected to statistical analysis. The analysis of variance and interpretation of data were done as per procedure given by Gomez and Gomez (1984). The experimental data of 2007 (*Rabi*) and 2008 (*Kharif*) were used for combined analysis to arrive best treatment combination effect.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

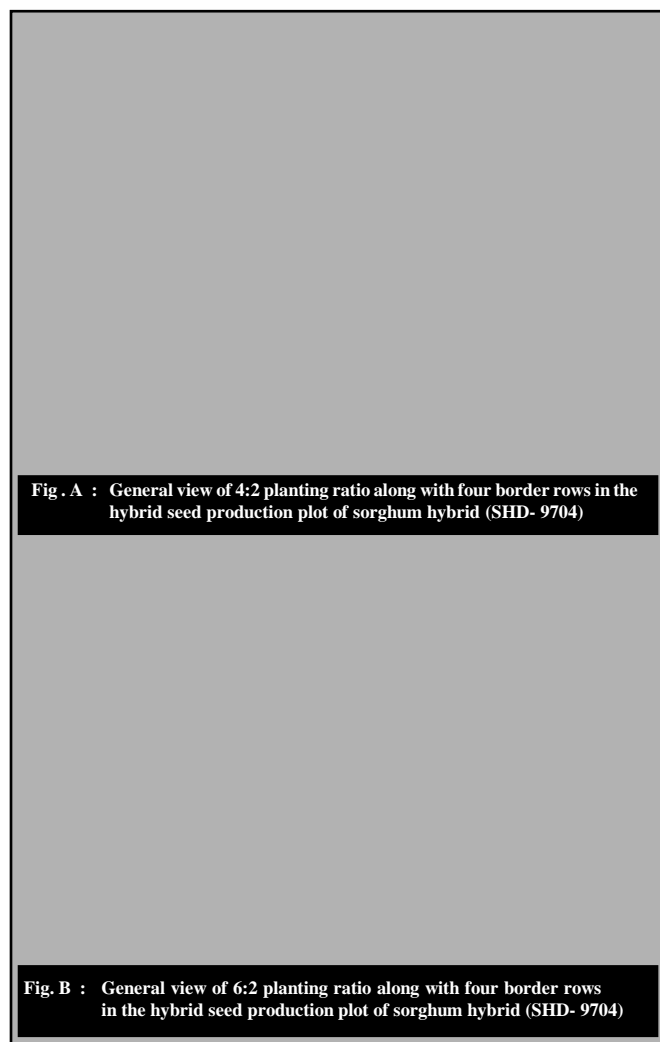
Growth parameters :

Results of this study revealed non-significant differences on growth parameters like plant height, leaf number, leaf area, leaf area index and crop maturity due to 4:2 and 6:2 planting ratios in both the years of experiments as well as combined year analysis are presented in Table 1.

Between two planting ratios, 6:2 planting ratio (P_2) recorded numerically more plant height (106.58 cm) at harvest, number of leaves (9.53) at 75 DAS and longer crop maturity period (93.84 days) over the 4:2 planting ratio (P_1) (101.01 cm, 9.22 and 90.71 days, respectively). On the other hand, leaf area (3068 cm²) and leaf area index (4.54) at 75 DAS was numerically more in 4:2 planting ratio (P_1) over 6:2 planting ratio (P_2) (2968 cm² and 4.39, respectively). These results indicated that unlike 6:2 planting ratio, the 4:2 planting ratio had shown a good response in registering higher leaf area and leaf area index, which determine the source to sink relationship. On an average, it is observed that planting ratio did not exert significant influence on the various growth parameters studied. It may be perhaps related to the fact that providing planting ratio is a mere agronomic manipulation rather than a technique or practice and hence, it has shown non-significant statistical effect. These results are in conformity with earlier results of Kathavate (1967) and Veeranagoudar (1999).

Flowering parameters :

The non-significant variations were observed due to 4:2 and 6:2 planting ratios for the flowering parameters such as days to flower primordial initiation and 50 per cent flowering in both the years of experiments and pooled analysis are presented in Table 2. However, period for flower primordial initiation and 50 per cent flowering was relatively shorter (35.83 and 66.88 days) in 4:2 planting ratio (P_1) than 6:2 planting ratio (P_2) (37.64 and 69.04 days) (Plate 1). In this study, the earliness in primordial initiation and 50 per cent flowering noticed in the 4:2 planting ratio may be related to its higher leaf area and leaf



area index over 6:2 planting ratio, as noticed in this study. The similar findings on flowering parameters due to planting ratios were also reported by Patil and Bharud (1991) and Veeranagoudar (1999).

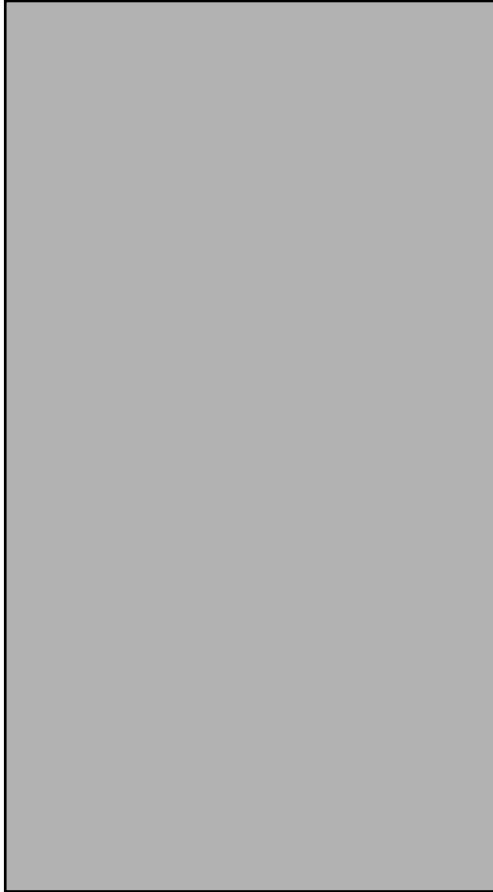


Plate 1 : Effective synchronization was observed in 4:2 planting ratio as compared to 6:2 planting ratio in seed production plot of sorghum hybrid (SHD-9704)

Hybrid seed yield and yield parameters :

It is seen from results of the study that effect of planting ratios was found significant for various hybrid seed yield components like ear weight (Table 2), number of seed per ear, seed setting percentage, seed weight per ear and hybrid seed yield per hectare in both years of experiment as well as pooled analysis are presented in Table 3. On an average 4:2 planting ratio (P_1) recorded significantly more ear weight (27.64 g), number of seeds per ear (300.00), seed setting percentage (26.77%) (Plate 2), seed weight per ear (10.32 g) and hybrid seed yield per ha (4.54 q/ha) (Fig .1)

Table 1 : Effect of planting ratios on plant height (cm) at harvest, Number of leaves at 75 DAS, Leaf area (cm^2) at 75 DAS and Leaf Area Index at 75 DAS on female parent of sorghum hybrid cv. SHD-9704

Treatments	Plant height at harvest (cm)			Number of leaves at 75 DAS			Leaf area (cm^2) at 75 DAS			Leaf Area Index at 75 DAS		
	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data
P_1	98.85	103.17	101.01	9.12	9.33	9.22	3004	3132	3068	4.45	4.64	4.54
P_2	104.42	108.75	106.58	9.41	9.66	9.53	2909	3026	2968	4.31	4.48	4.39
Mean	101.63	105.96	103.80	9.26	9.49	9.38	2957	3079	3018	4.38	4.56	4.47
	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.
	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%
P	2.90 NS	3.30 NS	3.08 NS	0.03 NS	0.15 NS	0.08 NS	59 NS	70 NS	65 NS	0.09 NS	0.11 NS	0.03 NS

NS – Non significant, DAS– Days after sowing, Planting ratios (P_1 , P_2 –4:2 (Female : Male), P_3 – 6:2 (Female : Male)

Table 2 : Effect of planting ratios on Days to crop maturity, Days to flower primordium initiation, Days to 50% flowering and Ear weight (g) on female parent of sorghum hybrid cv. SHD-9704

Treatments	Days to crop maturity			Days to flower primordium initiation			Days to 50% flowering			Ear weight (g)		
	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data	Rabi 2007-08	Kharif 2008-09	Pooled data
P_1	91.50	89.92	90.71	36.67	35.00	35.83	67.42	66.33	66.88	26.33	28.95	27.64
P_2	94.75	92.93	93.84	38.39	36.89	37.54	69.53	68.50	69.04	22.73	25.19	23.99
Mean	93.13	91.43	92.28	37.53	35.95	36.74	68.50	67.42	67.96	24.55	27.07	25.81
	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.	S.E. C.D.
	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%	\pm at 5%
P	1.96 NS	2.32 NS	2.13 NS	1.92 NS	1.79 NS	1.85 NS	0.75 NS	1.09 NS	0.91 NS	0.21 NS	0.63 NS	0.34 NS

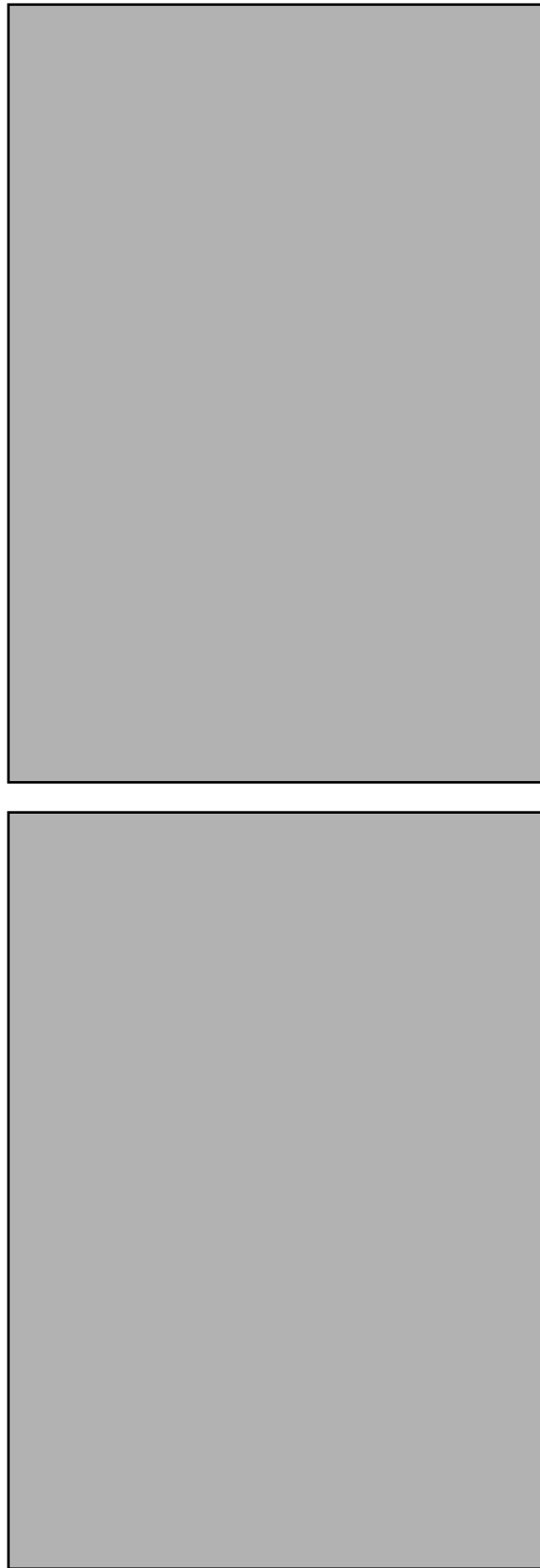
NS – Non significant, Planting ratios (P_1 , P_2 –4:2 (Female : Male), P_3 – 6:2 (Female : Male)

Table 3 : Effect of planting ratios on ear weight (g), number of seeds per ear, seed setting percentage, seed weight per ear (g) and hybrid seed yield per hectare (q/ha) on female parent of sorghum hybrid cv. SHD-9704

Treatments	Number of seeds per ear			Seed setting percentage			Seed weight per ear (g)			Hybrid seed yield per hectare (q/ha)		
	Rahi 2007-08	Kharif 2008-09	Pooled data	Rahi 2007-08	Kharif 2008-09	Pooled data	Rahi 2007-08	Kharif 2008-09	Pooled data	Rahi 2007-08	Kharif 2008-09	Pooled data
P ₁	281	320	300	25.32	26.77	26.77	9.63	11.00	10.32	4.16	4.93	4.54
P ₂	239	277	253	22.30	23.41	23.41	8.33	9.37	8.85	3.57	4.34	3.96
Mean	260	299	279	23.81	25.09	25.09	8.93	10.18	9.58	3.86	4.64	4.25
	S.E.	C.D.	S.E.	C.D.	S.E.	C.D.	S.E.	C.D.	S.E.	C.D.	S.E.	C.D.
	±	at 5%	±	at 5%	±	at 5%	±	at 5%	±	at 5%	±	at 5%
P	13	38	9	27	11	31	0.31	0.93	0.44	1.32	0.30	0.90
	0.19	0.57	0.15	0.45	0.11	0.33	0.08	0.25	0.09	0.27	0.08	0.25

NS – Non significant. Planting ratios (P). P₁ – 4:2 (Female : Male). P₂ – 6:2 (Female : Male)

Plate 2: Panicle development of female parent sorghum hybrid (SHD-9704) in different planting ratios



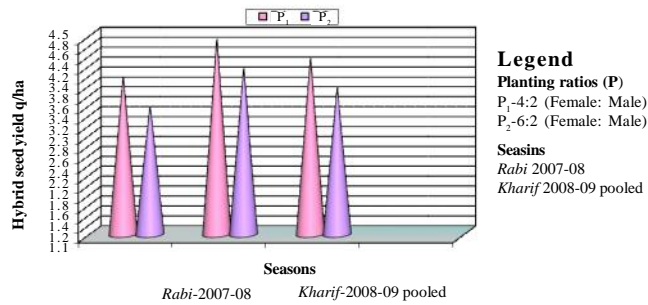


Fig. 1: Effect of planting ratios on hybrid seed yield q/ha on female parent

compared to 6:2 planting ratio (P₂) (23.99 g, 258.00, 23.41%, 8.85 g and 3.96 q/ha, respectively). Further, it is also seen that about 14.64 percentage increase in hybrid seed yield was obtained in the 4:2 planting ratio over 6:2 planting ratio and this it may be probably attributed to higher leaf area, leaf area index, earliness in flower primordial initiation and 50 per cent flowering noticed in 4:2 ratio over 6:2 planting ratio. Obviously it resulted in the increased hybrid seed yield components as an evident from the results of this study. The increased hybrid seed yield per hectare noticed in 4:2 planting ratio may also be related to availability of viable pollens from male parent to the female parent during flowering period and it resulted in higher hybrid seed setting (26.15%) and hybrid seed yield per plant (10.32 g) compared to 6:2 planting ratio. Similar line of significant influence of planting ratio on hybrid seed yield components was also reported by earlier workers like Patil and Goud (1980), Singh and Katare (1981) and Veeranagoudar (1999) in sorghum and Sachan *et al.* (2004) in yellow sarson.

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