

## Influence of sowing dates on quality hybrid seed production of sorghum

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**ABSTRACT** Studies on influence of sowing dates on quality hybrid seed production of sorghum, CSH 16 revealed that the parental lines of CSH 16 sown on 1.10.2014 were near to synchronization of flowering and took more days for completion of flowering as compared to the other two dates (17.10.2014 and 31.10.2014) of sowing. Higher grain yield plant 1 was recorded when the parental lines were sown on 01.10.2015 as compared to the later sowings. Delay in sowings by 15 days and one month *i.e.*, from first of October to mid of October and end of October, reduced the yield of the crop by 13.89% and 53.28%, respectively. Germination percentage of the hybrid seed harvested from crop sown on 1.10.2014 was highest (90%) to the hybrid seed harvested from the crop sown on 17.10.2014 and 31.10.2015. Therefore it is evident that early sowing (first week of October) of parental lines of sorghum hybrid CSH 16 results in higher hybrid seed yield with seed quality.

**Keywords:** Hybrid seed production, sorghum, sowing dates

Timely sowing is one of the basic agronomic practices which has a greater role on seed productivity, particularly in India where the optimum time of sowing varies considerably due to varied agro climatic conditions and intricate crop weather relationships. The fluctuations in weather and monsoon, farmers frequently experience the problem of delayed planting, non-synchronous flowering, poor seed setting and low seed yields.

Seed yield can be enhanced to a greater extent with the adoption of hybrids. However, difference in flowering behavior of the parental lines is one of the hindrance in realizing higher seed yield in hybrid seed production of jowar, which has significant effect on seed set. Thus, the most important determining factor in the hybrid seed production of jowar is the synchronization of male and female parents. To achieve effective seed set, stigma receptivity and stage of anthesis of seed and pollinator parents are important. Hence, identification of suitable sowing date to achieve synchronization of male and female parents and maximization

of seed yield and also for realizing good quality produce in hybrid seed production of jowar need to be given priority.

### MATERIALS AND METHODS

Parental lines of jowar hybrid, CSH 16 (27A × C 43) were sown with a gap of four days (A line was sown first, while R line was sown) at RARS, Nandyal 4 days later during *rabi* 2014-15. The experiment was taken up in RBD with three replications and the plot size for each treatment was 54 m<sup>2</sup> with a spacing of 45 × 15 cm. Sowing of female parent and the male parents of hybrid, CSH 16 was staggered at three dates *i.e.*, 01.10.2014 and 04.10.2014, 17.10.2014 and 20.10.2014 and 31.10.2014 and 03.11.2014, respectively. Observations were recorded on days to first flowering, days to 50% flowering, days for completion of flowering, duration of flowering, time of anthesis, duration of glume opening, % stigma exertion, % seed setting, seed yield/plant and seed quality attributes *viz.*, germination, root length, shoot length, seedling length, seedling vigour index I and seedling vigour index II.

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One hundred seeds from each treatment and replication were evaluated for germination using between paper method [1]. The normal seedlings were counted and expressed as germination percentage.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds plated}} \times 100$$

Ten seedlings were selected at random in each replication from germination test (between paper) for recording seedling length (cm). The same seedlings were dried in hot air oven at 80°C for 24 h and seedling dry weight was recorded in grams. Seedling vigour index (SVI) was calculated [2] following standard procedure.

i. SVI on length basis =  
Average seedling length x Germination percent

ii. SVI on dry weight basis =  
Average seedling dry weight x Germination percent

## RESULTS AND DISCUSSION

Analysis of data showed that the sowing dates significantly influenced the flowering behavior, yield and yield components as well as seed quality parameters (Table 1). The female parent of sorghum hybrid, CSH 16 took less number of days to first flowering. However, the time taken for initiation of flowering was increased by two days when the sowing of the parental lines was delayed by one month. Days taken for first flowering (52 days) and 50% flowering was low (56 days) when the crop was sown on 01.10.2014 followed by sowings on 17.10.2014 (52.7 days and 56 days) and 31.10.2014 (54 days and 57.3 days). Similar results of increase in number of days for 50% flowering were also reported in sunflower under delayed sowings and increased gradually and it varied from 55 to 63 days [3]. In maize, delayed planting increased the thermal time interval from planting to mid silking [4].

Parents of sorghum hybrid, CSH 16 sown on 1.10.2014 took more days for maturity (107 days) as compared to delayed sowings on 17.10.2014 (98 days) and 31.10.2014 (95 days). It was noted that the time of flowering and the duration of growth strongly influence the climatic adaptation and yield potential of a crop [5]. It was reported that lower temperature during the early growth stage in the dry season delayed flower initiation and extended maturity [6]. Flowering duration of the female parent was spread over for a period of 12.7 days when parental lines were sown on 1.10.2014 and the spread was for 8.6 days in crop sown on 17.10.14 and was 6.3 days in crop sown on 31.10.2014. Pollen shedding on the restorer parent continued for 10.0 days, while it was for a period of 11.0 days and 9.7 days in crops sown on 17.10.2014 and 31.10.2014, respectively. The presence of cool climatic conditions in the month of November (19.9°C) and December (18.2°C) could be one of the reasons for prolonged flowering and pollen shedding in the parental lines.

Parental lines of sorghum hybrid CSH 16 sown on 1.10.2014 were near to synchronization of flowering and took more days for completion of flowering (12.7 days) as compared to the other two dates (17.10.2014 and 31.10.2014) of sowing. Significant increase in seed setting percent, grain yield plant<sup>-1</sup> and 1000 grain weight was observed. Though perfect synchrony in flowering between male and female parents was observed when the parental lines were sown on 17.10.2014, reduction in seed setting percent, grain yield plant<sup>-1</sup> and 1000 grain weight was observed because of short flowering duration (8.6 days). Synchrony in flowering was observed when parents were sown on 31.10.2014 and duration of flowering was for a very short (6.3 days). As a result, reduction in seed setting percent, grain yield plant<sup>-1</sup> and 1000 grain weight was observed.

**Table 1. Flowering behaviour and seed yield of the parental lines of sorghum hybrid, CSH 16**

Dates of sowing	Line	Days to 1 <sup>st</sup> flowering	Days to 50% flowering	Days to completion of flowering	Days to maturity	Seed setting (%)	Grain yield/plant (g)	1000 grain weight(g)
1.10.2014	CSH 16	52.0	56.0	64.7	107.0	70	65.813	28.8
04.10.2014	R-C43	56.7	59.7	66.7	106.0	100	74.033	32.3
17.10.2014	CSH 16	52.7	56.0	61.3	98.0	60	56.673	24.7
20.10.2014	R-C43	52.7	57.3	63.7	95.7	100	64.333	29.2
31.10.2014	CSH 16	54.0	57.3	60.3	94.7	40	30.747	19.5
03.11.2014	R-C43	53.0	58.3	62.7	95.3	100	40.327	27.4

Sowing dates significantly influenced the seed setting percent. Seventy percent seed setting was noticed when the crop was sown on 01.10.2014 and was found to be significantly superior as compared to the crop sown on 17.10.2014 (60) and 31.10.2014 (40.0). High pollen viability and synchrony in flowering between the parental lines in October (early) sown crop might have resulted in good seed setting and higher yield. Low seed setting and consequently low yields were realized with late sowings, which could be due to low pollen availability and slow crop growth. Low temperature, low availability and reduced translocation of photosynthates to the developing spikes are the climate and physiological factors for low seed setting and yield. Further, high day temperatures and soil temperatures might have also led to desiccation of pollen grains, fertilization and seed setting. It was observed that early sown groundnut crop recorded

more number of pods while late sown crop recorded less number of pods plant<sup>-1</sup> [7].

Time of sowing significantly influenced grain yield plant<sup>-1</sup> (Table 1 and Fig 1). The parental lines of sorghum hybrid CSH 16 sown on 01.10.2014 recorded higher grain yield plant<sup>-1</sup> (65.813 g/plant), followed by sowings on 17.10.2014 (56.673 g/plant) and 31.10.2014 (30.747 g/plant). Delay in sowing by one month *i.e.*, from first of October to end of October, reduced the yield of the crop by 53.28%. Grain yield was reduced by 13.89%, when the sowing was delayed by 15 days *i.e.*, from first of October to second fortnight of October. Higher yields realized with early sowings might be due to abundant availability of pollen and perfect synchrony between the parental lines, more number of growing degree days and photo thermal period. Higher temperatures (21-22°C) coupled with rainfall during the flowering period of the crop (sown on 17.10.2014) might have led to desiccation of pollen grains and fertilization. Further, the presence of low mean temperatures (16.87°C) coupled with long sunshine hours (7.20) during the flowering period might have led to inadequate pollen availability, low pollen viability, seed setting and seed yield when the sowings were delayed by one month. The correlation between the sowing dates and grain yield, and occurrence of more brittle grains and storage problems under late planting was observed [8]. In addition, 4-6% reduction in grain yield

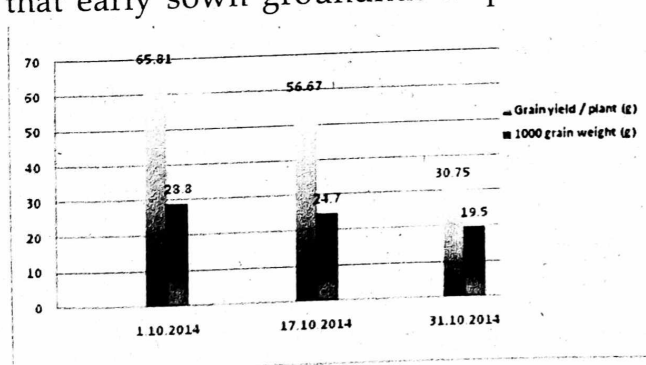


Fig. 1. Influence of dates of sowing on seed yield and test weight of the seed parent hybrid seed production of sorghum hybrid, CSH 16.

ha<sup>-1</sup> was also reported under late sown conditions. Grain brittleness was due to high stand density, poor nitrogen supply and irrigation.

There could be several other reasons for such inconsistencies in realization of seed yield at different sowing dates. The soil conditions at different sowing dates will inevitably be different besides unfavorable conditions *viz.*, excess or deficiency of soil moisture, incidence of pests and diseases etc. during crop growth period; Firstly the differences observed in the performance of crops sown at different dates are reflections of differences in plant density. Secondly, crops sown at different dates of sowing might have experienced different environmental conditions *viz.*, photoperiod and temperature at development stages of crop. The present findings are partly in concurrence of the results reported in maize [9-10].

Seed quality parameters *viz.*, germination percent, root length, shoot length, seedling length and seedling vigour index are presented in Table 2. Significant differences were observed among the sowing dates for the seed quality characters. Germination percent of the hybrid seed harvested from crop sown on 1.10.2014 was highest (90%) to the hybrid seed harvested from the crop sown on 17.10.2014 (86%) and last week of October (85%). A 5.5 percent decrease in germination percent was noticed when the sowings were delayed by one month, but the germination

percentage recorded with sowings in the last week of October was above the Indian Minimum Seed Certification Standards (75%). Decrease in germination percent with delay in sowing might be due to the occurrence of rains during seed setting stage and might have affected the quality of seed, resulting in low germination (85%) and less seedling vigour on seedling length basis (2231). Further, decrease in germination percentage with the advancement of sowing date might also be due to inadequate supply of plant nutrients at growth stages and reduction in translocation of photosynthates from the source to sink. This is in conformity with the results in sesamum [11] and in soybean [12].

Seedling length was observed to be high in crop sown on 01.10.2014 (31.69 cm), followed by mid - October (31.40 cm) but was reduced in the crop sown at the end of October (26.46 cm). Further, Seedling vigour Index I was more 01.10.2014 within sowings (2837), followed by mid-October (2713) and end of October (2231) sowings. High germination and seedling vigour realized in the harvested produce of the crop sown on 01.10.2015 could be due to the prevalence of bright sunshine hours and less relative humidity at the harvesting period. Seedling vigour was reduced by 4.37 percent, when the sowing of the parental lines of sorghum hybrid, CSH 16 was delayed by 15 days and by 21.4 percent when the sowing was delayed by 30 days. Presence of low temperatures

**Table 2. Seed quality characters of sorghum hybrid, CSH 16**

Dates of sowing	Parental lines	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Seedling vigour index I
1.10.2014	CSH 16	90	14.82	16.86	31.69	2837
04.10.2014	C 43R	92	15.76	14.80	30.56	2788
17.10.2014	CSH 16	86	13.56	17.84	31.40	2713
20.10.2014	C 43R	91	15.55	15.39	30.94	2777
31.10.2014	CSH 16	85	9.85	16.61	26.46	2231
03.11.2014	C 43R	96	14.55	16.35	30.90	2976

(16.87°C) might have led to slow growth of the plant, leading to inadequate supply of nutrients at growth stages and reduction in translocation of photosynthates from source to sink. It was demonstrated that time of sowing influenced soybean seed quality and found that hotter environmental conditions were associated with lower quality of harvested seeds [13].

From the present study, it is evident that early sowings (first week of October) of parental lines of sorghum hybrid CSH 16 results in higher hybrid seed yield with seed quality. The delayed sowings (17.10.2014 and 31.10.2014) were not found ideal for realizing optimum seed yield and seed quality.

## REFERENCES

1. ISTA (1985). International rules for seed testing (ISTA). *Seed Sci Technol* 27: 30-5.
2. ABDUL-BAKI AA AND ANDERSON JD (1973). Vigour determination in soybean seed by multiple criteria. *Crop Sci* 13: 630-3.
3. DUTTA A (2011). Effects of sowing dates on yield and yield components of hybrid sunflower (*Helianthus annuus* L.) in non-traditional areas of West Bengal. *J Crop Weed* 7 (2): 226- 8.
4. DAYNARD DT AND DUNCAN WG (1972). The black layer and grain maturity in corn. *Crop Sci* 9 (3): 473-6.
5. WILSON DR AND ROBSON M (1996). Pea phenology responses to temperature and photoperiod. *Proceedings the 8th Aus Agro Confe*, Toowoomba. 590-3.
6. BANTERNG P, PATANOTHAI A, PANNANGPETCH K AND JOGLOY S (2003). Seasonal variation in the dynamic growth and development traits of peanut lines. *J Agril Sci* 141 (1): 51-62.
7. AHMED N, MOHAMMAD R AND ULASKHAN (2007). Evaluation of various sowing dates for groundnut varieties under agro-ecological conditions of malakand division. *Gomal Univ J Res* 23 (2): 1-4.
8. BAUER P AND CARTER PR (1986). Effect of planting date, plant density, moisture availability and soil nitrogen fertility on maize kernel breakage susceptibility. *Crop Sci* 26: 1220-6.
9. NAMAKKA A, ABUBAKAR IU, SADIKIA, SHARIFAI AI AND HASSAS AH (2008). Effect of sowing date and nitrogen level on yield and yield components of two extra early maize varieties (*Zea mays* L.) in Sudan savanna of Nigeria. *ARPN J of Agril Biological Sci* 3 (2): 1-5.
10. KAMARA AY, EKELEME F, MENKIR A, CHIKOYE D AND OMOIGUI LO (2009). Influence of nitrogen fertilization on the performance of early and late-maturing maize cultivars under natural infestation with *Strig hermonthica*. *Archives Agro Soil Sci* 55 (2): 125-45.
11. PADMA V AND MADHUSUDHANA RAO DV (1992). Influence of sowing dates and season on growth, development and yield of groundnut (*Arachishypogaea*). *J Oilseeds Res* 9 (1): 33-4.
12. SAINISK, SINGH JN AND GUPTA PC (1980). Effect of planting date and variety on seed quality of soybean. *Seed Res* 8 (2): 141-9.
13. ADAM NM, MCDONALD MB AND HENDERLONG PR (1989). The influence of seed position, planting and harvesting dates on soybean seed quality. *Seed Sci Technol* 17: 143-53.