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Influence of various sowing dates on growth, yield and economics of different fodder sorghum genotypes

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Abstract
The experiment was carried out to study the influence of various sowing dates on growth, yield and economics of different fodder genotypes during *kharif* 2018. The results revealed that significantly higher growth attributes at 60DAS (1st cutting) and at 60 days after 1st cut such as plant height (192.74 and 184.71 cm), number of functional leaves (10.07 and 9.86), leaf area plant-1 (39.18 and 38.16 dm2), dry matter weight plant-1 (40.27 and 38.24 g) and stem diameter plant-1 (1.98 and 1.93 cm). Were recorded with 23th MW (07 June) sowing than sowing at 25th and 27th MW. Similarly, among the various fodder genotypes the results revealed that significantly higher growth attributes were recorded by the genotype SSG-59-3 at 60DAS (1st cutting) and at 60 days after 1st cut such as plant height (178.32 and 175.08 cm), number of functional leaves (9.20 and 8.49), leaf area plant-1 (36.00 and 35.20 dm2), dry matter weight plant-1 (33.83 and 36.04 g) and stem diameter plant-1 (1.83and 1.74 cm) than SSG-898 and Ankur Heera. With regards to yield and economics, the highest green forage yield (712.05 q ha-1), dry forage yield (199.27 q ha-1) and B: C ratio (4.97) were found in earlier sowing time (23rdMW - 07 June) as compared to later sowing dates 25th (24 June) and 27th (MW -7 July). Similarly in case of different fodder genotypes, the fodder sorghum genotype SSG-59-3 recorded maximum green forage yield (670.67 q ha-1), dry forage yield (183.84 q ha-1) and B: C ratio (4.68).

Keywords: Sowing dates, fodder sorghum genotypes, growth, yield, economics

Introduction
Forages are the mainstay of animal wealth and their production. The scarcity of green forages and grazing resources in the country has made the livestock to suffer continuously with malnutrition resulting in their production potentiality at sub optimum level as compared to many developed nations. It is pertinent to recall that out of the total cost of milk production, the feed cost alone accounts for 65 to 70%.

Sorghum is an important forage crop which is widely grown to meet the green as well as dry fodder requirement of the livestock. It is fast growing, quick in recovery after cutting, palatable, nutritious and utilized as silage and hay, besides for fresh feeding. Sorghum plant is unique in stature with its wide adaption to changing climatic conditions.

Sowing of the crop at right time ensures better plant growth and also inhibits weed growth. There are evidences that optimum time of sowing is one of the several cultural manipulations and play vital role in boosting up the yield. The proper sowing time exerts a marked effect on the growth and eventually on the further cutting management and cumulative forage yield of a crop. Besides sowing time, suitable genotype also influence the overall performance of the crop. Genetic exploitation of sorghum for increasing yield and quality fodder sorghum has played a significant role in increasing fodder production (Aruna *et al*., 2015) [1]. Identification of good quality sorghum genotypes and development of location specific production technology offer an excellent opportunity to provide adequate fodder with better nutrition to bovine population (Singh and Sumeriya, 2012) [9].

Methodology
The experiment was laid out at the Farm of Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, (Maharashtra) during *kharif* season of 2018. The soil of experimental plot was clayey in texture, medium in organic carbon, low in available nitrogen, phosphorus and high in potash.

In the present investigation three sowing dates (23 MW-07 June, 25 MW-24 June, 27 MW -7 July) were undertaken to create a different set of environmental conditions and three fodder sorghum genotypes (SSG-59-3, SSG-898 and Ankur Heera) were tested. The experiment was

laid out in factorial randomized block design with three replications consisting of nine treatment combinations in each. The objective was to study the influence of sowing time on growth, forage yield in subsequent yield and quality parameters of different fodder sorghum genotypes, identifying promising fodder sorghum genotypes in terms of growth, forage yield and quality and to work out the economics of different treatments. The recommended dose of 100:50:50: kg $N:P_2O_5:K_2O$ ha^{-1} was applied Half the dose of urea and full dose of SSP and MOP was applied at the time of sowing. Remaining half dose of urea was top dressed at first cut stage (60 DAS) of respective sowing date.

Results

Sowing Date

Different sowing time significantly influenced the various growth attributes such as plant height(cm), number of functional leaves, leaf area $plant^{-1}$ (dm^2), dry matter weight $plant^{-1}$ (g) and stem diameter $plant^{-1}$ (cm) at 60 DAS and at 60 days after 1st cut. The significantly higher growth attributes were recorded in S_1 (23rdMW) sowing date at 60 DAS and at 60 days after 1st cut than other sowing dates. (Table 1) The increased plant height in early sowing might be due to the enhanced vegetative development of crop under favourable weather condition, particularly favourable rainfall and hence soil moisture regime throughout the growing period that facilitated better shoot growth. The results are in close accordance with the finding of Shivdhar *et al.*, (2005), Burks *et al*., (2013) [3], Rao *et al.* (2013) [6] and Karhale *et al.,* (2014) [4].

Highest green (712.05 q ha^{-1}) and dry forage (199.27 q ha^{-1}) yields were found in earlier sowing date S_1 (23rdMW - 07 June) as compared to later sowings S_2 and S_3. Lowest green (583.76 q ha^{-1}) and dry forage (163.26 q ha^{-1}) yields were recorded in 27 MW - 07 July sowing (S_3). (Table 2) Higher green and dry forage yields with 7th June sowing (S_1-24MW) was due to better expression of growth characters like plant height, dry matter production and leaf area due to favorable weather and soil moisture regime encountered across crop growing period in earlier sowing as compared to later sowings. The results obtained during the investigation are in close accordance with the finding of Shivdhar *et al*., (2015). B:C ration was maximum (4.97) with early sowing (S_1) than late sowings (S_2 and S_3). Cost of the cultivation was similar across different sowing times. Earlier sowing resulted in better growth performance of fodder sorghum and consequently higher fodder output and in turn higher monetary returns.

Genotype

Growth attributes were significantly influenced with different fodder sorghum genotypes The significantly higher values at 60 DAS (1stcutting) and at 60 DAS after 1st cut pertaining to plant height (cm), number of functional leaves, leaf area $plant^{-1}$ (dm^2), dry matter weight $plant^{-1}$ (g) and stem diameter $plant^{-1}$ (cm) were recorded in the fodder sorghum genotypes SSG-59-3 over SSG-898 and Ankur-Heera (Table 1). Differences observed for various growth attributes among genotypes can be primarily attributed to variation in genetic makeup of plants. The results obtained during the investigation are in close accordance with the finding of Mali *et al.,* (2000) [5] and Sumeriya *et al.,* (2008).

Maximum green forage yield (670.67 q ha^{-1}) was found to be with fodder sorghum genotype SSG-59-3 and was significantly superior as compared to rest of the genotypes. Comparable results were observed regarding dry forage yield amongst Genotype SSG-59-3 and SSG-898. Ankur-Heera recorded the least green forage (634.17 q ha^{-1}) and dry forage (172.27 q ha^{-1}) yields. (Table 2) This might be due to the inherent characteristics of the genotype, its yield potential and acclimatization with the prevailing environmental condition. Photosynthetic efficiency of a plant to convert its photosynthates into production is an integrated effect of genetic makeup of genotype and its growing condition. The results obtained are in close agreement with the findings of Tudu *et al*. (2004) [11], Bhoya *et al*. (2013) [2], Satpal *et al*., (2015) and Shinde *et al*., (2015) [8]. Similarly B:C ratio obtained was maximum with genotype SSG-59-3 (4.68) followed by SSG-898 (4.56) and Ankur-Heera (4.43).

Interaction

The interaction effects of different sowing times and genotypes did not exert any significant influence on various growth attributes, yield and economics.

Table 1: Growth attributes as influenced by different treatments

Treatment	Plant height $plant^{-1}$ (cm)		Number of functional leaves		Leaf area $plant^{-1}$ (dm^2)		Dry matter weight $plant^{-1}$ (g)		Stem diameter $plant^{-1}$ (cm)	
	60 DAS	60 days after Ist cutting	60 DAS	60 days after Ist cutting	60 DAS	60 days after Ist cutting	60 DAS	60 days after Ist cutting	60 DAS	60 days after Ist cutting
Sowing time										
S_1 - 23th MW (07 June)	192.74	184.71	10.07	9.86	39.18	38.16	40.27	38.24	1.98	1.93
S_2 - 25th MW (24 June)	165.29	161.1 0	8.01	7.79	29.66	28.06	33.14	31.83	1.75	1.57
S_3 - 27th MW (07 July)	148.27	147.67	7.07	7.01	26.51	23.54	27.16	32.30	1.40	1.42
SE (m) ±	2.92	2.48	0.29	0.29	1.02	0.53	1.16	1.36	0.06	0.17
CD (P=0.05)	8.75	7.44	0.88	0.86	3.06	1.60	3.48	4.07	0.19	0.15
Genotype										
V_1 - SSG-59-3	178.32	175.08	9.20	8.49	36.00	35.20	33.83	36.04	1.83	1.74
V_2 - SSG-898	166.81	163.84	8.20	8.17	30.70	28.50	32.23	35.04	1.73	1.64
V_3 - Ankur-Heera	161.17	155.56	7.75	7.33	27.29	25.12	30.20	31.28	1.56	1.53
SE (m) ±	2.92	2.48	0.29	0.29	1.02	0.53	1.16	1.36	0.06	0.17
CD (P=0.05)	8.75	7.44	0.88	0.86	3.06	1.60	3.48	4.07	0.19	0.15

Interaction										
SE (m) ±	5.05	4.3	0.51	0.50	1.77	0.93	2.01	2.35	0.11	0.29
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
GM	168.76	164.82	8.38	8.21	30.79	28.90	33.52	34.12	1.71	1.64

Table 2: Green forage yield (q ha^{-1}), dry forage yield (q ha^{-1}) and economics as influenced by different treatments

Treatment	Green forage yield (q ha^{-1})	Dry forage yield (q ha^{-1})	*B : C ratio*
Sowing time			
S_1 - 23th MW (07 June)	712.05	199.27	4.97
S_2 - 25th MW (24 June)	660.34	170.94	4.62
S_3 - 27th MW (07 July)	583.76	163.26	4.08
SE (m) ±	2.85	2.66	-
CD (P=0.05)	8.53	7.96	-
Genotype			
V_1 - SSG-59-3	670.67	183.84	4.68
V_2 - SSG-898	651.30	177.36	4.56
V_3 - Ankur-Heera	634.17	172.27	4.43
SE (m) ±	2.85	2.66	-
CD (P=0.05)	8.53	7.96	-
Interaction			
SE (m) ±	4.93	4.6	-
CD (P=0.05)	NS	NS	-
GM	652.04	177.82	4.56

Conclusion

The sowing date S_1 (23rdMW - 07 June) recorded higher growth, yield and economics than other sowing dates. Similarly, the fodder genotype SSG-59-3 recorded higher growth, yield and economics than other genotypes.

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