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Effect of Different Sowing Dates on Growth and Yield of Kharif Sorghum Hybrids

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Abstract: *The experiment was conducted on experimental farm of Department of Agricultural Meteorology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during kharif season 2012-13 entitled as "Yield Forecasting of Sorghum by using Statistical Model" to find out most optimum meteorological week for sowing sorghum in kharif season, to study the relationship between meteorological parameters and yield and to develop statistical model for yield forecasting. The results were obtained from the experiment it was found that all the biometric observations (plant height, number of leaves, leaf area, LAI and dry matter) in kharif sorghum were significantly highest in treatment of sowing in 24 MW (11 to 17 June) followed by second sowing date 25 MW (18 to 24 June). Amongst the varieties all the biometric observations were recorded significantly highest in V_1 (PSH-71). Sowing in 24 MW significantly superior over the rest of treatments with production of highest grain yield 1482.10 kg ha^{-1} followed by sowing in second sowing date 25MW 1444.2 kg ha^{-1} which was at par with sowing in 24 MW in respect to all yield attributing characters and lowest grain yield was observed in fourth sowing i.e 27 MW 1119.31 kg ha^{-1}. Hence, sowing of kharif sorghum should be completed on 24 MW or before 25 MW; otherwise there is chance of reduction of grain yield with delayed sowing.*

Key words*: Kharif sorghum, sowing dates, yield attributes.*

I. Introduction

Sorghum (Sorghum bicolor (L.) Moench) is an important food crop in India and it is cultivated in tropical and subtropical climates, especially in the semi-arid tropics. It is the fifth most important cereal crop followed by rice, wheat, maize and barley in the world. In India, sorghum is extensively produced and both hybrid and improved varieties of sorghum are taken on large scale. In Maharashtra state, during kharif season jowar is cultivated on 8.82 Mha with production 1.342 Mt and productivity of 1498 kg/hectare. Rabi Sorghum plays an important role in dry land economy In Maharashtra. The area under rabi sorghum during 2011-12 was 2.38 lakhs hectare with production 1.35 Mt and productivity 567 kg/hectare (Anonymous 2012). Dryland farming is the backbone of Indian agriculture, as large areas of cultivated land are rainfed. The success or failure of dryland rainfed crops depends mostly on the pattern of monsoon rains. The distribution of rainfall in monsoon decides the yield of rainfed crops. To mitigate these losses of kharif sorghum, a field experiment was conducted to find out the suitable sowing date for sustainable yield of rainfed kharif sorghum under erratic behavior of monsoon.

II. Material And Methods

The experiment was conducted on experimental farm of Department of Agricultural Meteorology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during kharif season 2012-13. The experiment was conducted in split plot design with three replications. Treatment under study were four sowing dates as main treatment in kharif season i.e. 24th MW, 25th MW, 26th MW and 27th MW, and four different varieties as sub treatment i.e. PSH-71, MSH-51, BGL-296 and PVK-801 were sown with spacing 45x15 cm. The gross plot size was 3.60 x 2.25 m^2 and net plot size was 2.25x 1.8 m^2. The sowing of seed was done by dibbling method on respective date of sowing. Recommended packages of practices like thinning, weeding, application of recommended dose of fertilizer and pesticide were uniformly followed for each experiment. Observations were recorded on five plants randomly selected per treatment.

III. Results And Discussion

Weather condition during crop growth

Total rainfall during crop growth period (24 MW to 45 MW) received was 673.9 mm in 41 rainy days. The maximum and minimum temperature during crop growing period was ranged in between 30.0 to 38.4 ^{0}C and 15.6 to 26.3 ^{0}C respectively. The morning relative humidity (RH-I) ranged from 61.0 to 95.0 percent during crop growing season and RH-II ranged in between 26.0 to 72.0 percent during crop growing season.

It is observed that lowest and highest EVP 2.8 mm in 36th MW and 11.2 mm in 24th MW respectively. The mean BSS during crop growing period (from 24th to 45th MW) were 6.39 hrs per day. It was observed that the highest value of bright sunshine hours 10.1 hrs day^{-1} were recorded in 42 MW while, lowest BSS 2.7 hrs per day in 25 MW. Highest wind velocity 7.9 $kmhr^{-1}$ was recorded in 24th MW, while lowest wind velocity 2.0 $kmhr^{-1}$ was recorded in 41 MW.

1. Growth components

a) Plant height: - The plant height was observed significantly highest in first date of sowing i.e. 24 MW 157.0 cm at harvest than other date of sowing at all stages of crop growth. Lowest plant height was recorded in 27MW during all growth stages of crop. However, in 25MW and 26MW sowing plant height was observed at par with 24 MW at all the growth stages of crop. Among varieties variety V_1 (PSH-71) recorded significantly highest plat height than other varieties in all growing stages. The interaction effect between date of sowing and varieties was found non significant at all stages. Similar results for date of sowing for plant height were given by Iyanar et al. (2001), Shivadhara et al. (2005), Sonwar et al. (2008)

b) Number of functional leaves: - The mean number of leaves per plant was observed significantly highest in first date of sowing i.e. 24 MW (24 MW). Among varieties numbers of functional leaves were recorded significantly highest in V_1 (PSH-71) i.e. 9.76 per plant. The interaction effect between date of sowing and varieties was found non significant at all stages. Similar results for sowing dates and varieties in number of leaves in sorghum were given by Shivadhar et al. (2005) and Sonwar et al. (2008).

c) Leaf area $plant^{-1}$:- Leaf area were observed significantly highest in first sowing 24 MW 4144.3 cm^2 over all sowing dates. While, it was at par with second date of sowing (25 MW) at all the stages of crop growth. However, lowest leaf area was recorded in 27MW during all growth stages. Significantly highest leaf area was observed in V_1 i.e. (PSH-71) during all growing stages, expect in V_2 leaf area observed significantly highest at 60 DAS. While, the lowest leaf area was observed in V_4 (PVK-801) consistently up to harvest.

d) Dry matter production:- Significantly superior and highest dry matter was observed in sowing 24 MW (24 MW) at all growth stages than other date of sowing dates and it was at par with second sowing (25 MW) at 60 DAS. Among varieties significantly highest dry matter was observed in V_1 (PSH-71) at all the growth stages than other three varieties (V_2, V_3 and V_4).

2. Phenological parameters

a) Number of days required for 50 percent flowering:- The mean number of days required to 50 percent flowering was observed that 24 MW require significantly highest days to flowering (75.91 days) while, 27MW flowered significantly earlier (68.58 days) than other date of sowing. Similar results were reported by Baig and Shankiti (1994) for different date of sowing affects on 50 % flowering. Among varieties V_2 flowered significantly earlier (71.66 days) and highest days require to V_1 (72.50 days) and it was at par with all varieties.

b) Number of days required for physiological maturity:- Among the treatments of sowing in 24th MW matured significantly late (114.50 days) while 27 MW matured significantly earlier (105.5 days) than other date of sowing. It means that temperature gradient, low soil moisture and less quantum of rainfall early maturity was forced 27MW sowing naturally. It mature 10 days earlier than sowing.

3. Yield attributes

a)Test weight (gm) :- It was observed from data, that the mean test weight of kharif sorghum varieties was 30.43gm per 1000 seeds. The effect of different date of sowing on thousand seed weight (gm) was found to be significant. The second sowing 25MW (25 MW) showed significantly highest mean thousand seed weight over other date of sowing and it was at par with 24 MW and 26MW sowing date.

Sonwar et al. (2008) reported that the early sowing of kharif sweet sorghum gives highest test weight.

The effect of all four varieties on thousand seed weight was found significant. The variety V_1 (PSH-71) found to be significantly superior (31.83 gm) in mean thousand seed weight than other varieties. While, it was at par with V_3 (BGL-296). It because of varietal characters i.e. yield response to weather parameters. The interaction effect between date of sowing and different cultivars was found to be non significant.

b) Grain yield (kg ha^{-1}) :-The data indicated that mean grain yield per hectare of kharif sorghum was 1335.9 kg ha^{-1}.The data on mean seed yield indicated that among the sowing dates the crop sown in first sowing date 24 MW (24th MW) recorded significantly highest grain yield (1482.10 kg ha^{-1}) and lowest grain yield was observed in fourth sowing 27MW (27th MW). 24 MW was significantly superior over 26MW and 27MW while, it was at par with second sowing date 25MW (25th MW) and recorded seed yield 1444.2 kg ha^{-1}.

Similar results were reported by Firke and Kadam (1979), Umrani et al. (1988), Baig and Shankiti (1994), Bhoite and Nimbalkar (1997), Sunil Kausik et al. (2007), Jadhav et al. (2010). Also the results are conformity with Mishra et al. (2011).

Among the four varieties highest grain yield per ha^{-1} was observed in variety V_1 (PSH-71) 1451.31 kg ha^{-1} and lowest in V_4 (1230.2 kg ha^{-1}). The variety V_1 was recorded significantly superior yield over all the other varieties. The interaction effect between date of sowing and different varieties was found to be non significant for grain yield.

c) Fodder yield :- Data revealed that mean fodder yield of kharif sorghum influenced by different treatments and over all mean was recorded 6908.9 kg ha^{-1}. Among the sowing dates second sowing date 25MW (25^{th} MW) significantly highest fodder yield (7310 kg ha^{-1}) was recorded and lowest in 27MW (6541.1 kg ha^{-1}).While, it was at par with first date of sowing 24 MW (7261.3 kg ha^{-1}).Similar results were reported by Alma et al. (1995). The data on fodder yield indicated that significant difference amongst the varieties and it was observed that fodder yield highest and lowest recorded in V_1 (7228.2 kg ha^{-1}) and V_2 (6484.7 kg ha^{-1}) respectively. While, it was at par with V_2 (7069.9 kg ha^{-1}).

d) Biological yield :- Among the sowing dates second sowing date 24 MW (24^{th} MW) significantly highest biological yield was recorded (8743.4 kg ha^{-1}) and lowest in 27MW (7660.41 kg ha^{-1}). While, it was at par with second date of sowing 25MW (8741.8 kg ha^{-1}).Similar results are reported by Suchit K Rai et al. (2006). Among the four varieties highest biological yield was observed in variety V_1 (PSH-71) 8679.51 kg ha^{-1} and lowest in V_2 (7794.2 kg ha^{-1}). While, it was at par with V_3 (8422.6 kg ha^{-1}).

IV. Conclusion

On the basis of observations tabulation and analysis of data i.e. biometric and yield contributing character it was observed 24 MW sowing i.e. 24 MW (11 to 17 June) was showed significantly superior over rest of treatments with production of highest grain yield (1482.10 kg ha^{-1}) and total biological yield (8743.4 kg ha^{-1}), followed by in second sowing date 25MW in 25 MW (18 to 24 June) which is at par with 24 MW. It is therefore, recommended that sowing may be done in 24 MW (24 MW) (11 to 17 June) for highest grain yield, followed by 25MW (25 MW) (18 to 24 June) and variety V_1 (PSH-71) recommended for sowing in kharif season on the basis highest grain yield as well as fodder yield at Parbhani location.

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Table 1: - Different growth attributes

Treatments	Plant height (cm) at harvest	No of leaves at 60 DAS	Leaf area (cm^2) at 60 DAS	Dry matter (gm) at harvest	Days to 50 % flowering (DAS)	Days to Maturity (DAS)
Sowing Dates						
24 MW	157.00	9.91	4144.3	139.26	75.91	114.50
25 MW	156.28	9.05	3933.3	130.07	73.33	109.70
26 MW	153.84	8.99	3913.8	129.97	70.50	106.67
27 MW	136.20	7.76	3375.1	127.96	68.58	105.50
S.E. ±	2.26	0.37	98.09	1.92	0.54	0.30
CD at 5 %	6.59	1.08	285.88	5.59	1.62	0.87
Varieties						
V_1 PSH-71	157.56	9.76	3931.1	134.57	72.50	110.33

V_2 MSH-51	145.01	8.91	3946.8	133.45	71.66	107.92
V_3 BGL-296	149.64	9.12	3832.5	129.84	72.00	109.17
V_4 PVK-801	151.11	7.91	3656.2	129.40	72.16	109.00
SE ±	1.50	0.34	46.67	1.16	0.54	0.35
CD at 5 %	4.41	1.00	136.03	3.39	1.72	1.04
D x V Interaction						
S.E ±	3.01	0.69	93.34	2.33	1.08	0.71
CD at 5 %	NS	NS	NS	NS	NS	NS
G.M	150.83	8.93	3841.6	131.82	72.08	109.1

Table 2:- Mean test weight (gm), grain yield (kg ha^{-1}), fodder yield (kgha^{-1}) and biological yield (kg ha^{-1}) influenced by different treatments.

Treatments	**Test weight (gm)**	**Grain yield (kg ha^{-1})**	**Fodder yield (kg ha^{-1})**	**Biological yield (kg ha^{-1})**
Date of Sowing				
24 MW	30.60	1482.10	7261.3	8743.4
25MW	31.66	1431.30	7310.5	8741.8
26MW	31.28	1311.00	6522.6	7833.6
27MW	28.19	1119.31	6541.1	7660.41
SE ±	0.76	26.62	174.46	178.62
CD at 5 %	2.24	77.59	508.46	520.56
Varieties				
V_1 PSH-71	31.83	1451.31	7228.2	8679.51
V_2 MSH-51	29.25	1309.50	6484.7	7794.2
V_3 BGL-296	31.08	1352.7	7069.9	8422.6
V_4 PVK-801	29.58	1230.2	6847.7	8077.9
SE ±	0.50	23.23	179.77	183.96
CD at 5 %	1.47	67.71	523.92	536.13
D x V Interaction				
SE ±	1.01	46.47	359.54	367.91
CD at 5 %	NS	NS	NS	NS
G.M	30.43	1335.9	6908.9	8244.21