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Performance of Summer Pearl Millet (*Pennisetum glaucum* L.) Hybrids under North Gujarat Conditions

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A B S T R A C T

An experiment was conducted on plot number C-10, Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer season of the year 2012 on Loamy Sand soil. Four hybrids *viz.*, GHB 732, GHB 744, GHB 538 and GHB 558 were taken under study. Grain and dry fodder yields were significantly higher in case of hybrid GHB 558 as compared to GHB 744, GHB 538 and GHB 732. Similar response trend was observed in the growth attributes *viz.*, plant height at 60 DAS and harvest, total tillers per plant.

Introduction

The common name of pearl millet over large part of India is *bajra* or *bajri* which is low price food grain crop Pearl millet [*Pennisetum glaucum* (L.)] belong to Poaceae family. It is one of the most important cereal crops of India and rank 4th in area after rice, wheat and sorghum, which is grown in arid and semi-arid regions. India and Africa together account 93.2 per cent of the total pearl millet production of the world. The share of pearl millet in total food grain production is 10.7 per cent.

Pearl millet is the most widely cultivated cereal crop in India. It is grown on more than 8.39 m ha with current grain production of 9.15 MT and productivity of 1091 kg ha^{-1} during summer season (DES, 2012).

The nutritive values of the pearl millet grains are fairly high with 69.4 per cent carbohydrate, 12.1 per cent protein, 4.3 to 5.0 per cent fat, 2 to 7 per cent mineral matter and 2.4 per cent sugar. It is also rich in vitamins, thiamine and riboflavin contents and imparts substantial energy to the body with easy digestibility (Pal *et al.*, 1996).

The major pearl millet growing states of India are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana which account for more than 90% of pearl millet acreage in country. Pearl millet can easily provide economical grain yield (600–700 kg ha^{-1}) under marginal and low management conditions, with the additional ability to produce a grain yield of 4000-5000 kg ha^{-1} when hybrids (80-85 days maturity) are grown as a summer crop under irrigated and high fertility conditions.

The area under summer pearl millet was 3829 hundred hectares with an annual production of 941700 MT and productivity of 2459 kg ha^{-1} in the Gujarat state during 2011 (Anon., 2011a).

Adoption of high yielding short duration varieties which plays important role in the maximization of pearl millet production per unit area per unit time. Short duration and high yielding varieties of pearl millet can enhance the production. Screening of hybrid varieties which are appropriate to that particular climatic condition can help in boosting the production of pearl millet.

Materials and Methods

The field experiment was conducted on plot No. C-10 during summer season of 2012 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The summer season (March-June) is generally hot and dry. Occurrence of storms and winds with very high velocity is very common during summer season. May is the hottest month of the year. It was observed that the soil of experimental plot was loamy sand in texture. The soil was low in organic carbon and available nitrogen, medium in available phosphorous and potash. The soil was free from salinity/sodicity hazard.

The pearl millet hybrids GHB 732, GHB 744, GHB 538, and GHB 558 were selected for the present investigation. The pearl millet hybrids have been evolved at Main Millet Research Station, Junagadh Agricultural University, Jamnagar and released for commercial cultivation. During the study, following parameter was recorded in scientific manner.

Growth attributes

Plant population

The number of plants per meter row length from each net plot were counted after thinning and recorded per meter row length.

Plant height (cm)

Plant height was measured periodically from base of the plant (ground level) to the tip of the main shoot at 30 and 60 DAS as well as maturity. The mean height of five sample plants was worked out and recorded for each plot according to the treatment.

Tillers per plant

Tillers per plant of five randomly selected plants in each net plot was counted and recorded. The mean number of tillers per plant for each treatment plot was worked out and recorded for respective treatment.

Yield attributes and yield

The details of the yield attributing recorded during the period of investigation are described below

Effective tillers per plant

The tillers producing ear heads bearing grains were counted from the previously selected five plants and the mean value was worked out and recorded for respective treatment plot.

Length of ear head

The length from the base to the apex of the ear head of main ear head of the five tagged plants for all the plots were measured in cm. The mean value of five plants was worked out and recorded for respective treatment.

Girth of ear head

The ear heads used for measurement of length were also used for this parameter. Top, middle and bottom of ear head thickness was measured in cm by Vernier calliper and mean girth was computed for each ear head. The average girth of ear head was worked out for each treatment plot and recorded under respective treatment.

1000-grain weight

The composite sample of grains was collected from the grain yield of each net plot, from which 1000 grains were counted and their weight was recorded for respective treatment.

Grain yield (kg ha^{-1})

Ear heads of each net plot were threshed and cleaned separately and recorded for each respective treatment. Grain yield of five tagged plants was also added to respective net plot yield and finally net plot yield was worked out for respective treatment.

Dry fodder yield (kg ha^{-1})

After nipping the ear heads from net plot, the plant was cut and allowed to sundry for 8-10 days in respective treatment plot and then it was weighed repeatedly till constant weight obtained.

Dry fodder yield was calculated adding dry fodder yield of respective five tagged plants for treatment plot.

Results and Discussion

Meteorological data presented in Table 1 and Figure 1 showed that the weather parameters during the crop season were within the optimum limits, and were found conducive for normal growth and development of the crop. The data indicated that the maximum temperature ranged between 23.8 to 40.4^{o}C, while minimum temperature ranged between 5.3 to 26.7^{o}C during the period of experimentation. The relative humidity at morning ranged between 57 to 87 per cent and at evening ranged between 15 to 45 per cent and the sunshine hours ranged between 5.3 to 10.5 hours which were found normal (Fig. 1). No severe incidence of insect-pests was observed in the year under study. The initial and final plant populations were observed to be uniform.

Hybrids had non-significant effect on plant height of pearl millet recorded at 30 DAS (Table 2). Plant height significantly with 60 DAS and at harvest in hybrids, hybrid GHB 558 recorded higher plant height than those recorded GHB 732, GHB 538 and GHB 744.

The difference in plant height might be due to genetically make up of plant itself, which is governed by vegetative growth of crop as it played vital role in accelerating all the physiological processes in plants. These findings are in accordance with those reported by Singh and Singh (1971), Patel (1976), Patel (1981), Bagada and Patel (1983), Patel (1988), Dalshaniya (1993) and Patel (1995).

In general, differences in total tillers per plant were observed remarkably. Hybrid GHB 558 recorded more total tillers per plant. This increase was attributed to the genetical characteristics of hybrid GHB 558. Similar findings were also recorded by Singh and Singh (1971), Patel (1981), Bagada and Patel (1983), Dalshaniya (1993)

Characteristics of pearl millet hybrids

Sr.No.	Characters	Pearl millet hybrids			
		GHB 732	GHB 744	GHB 538	GHB 558
1.	Parents :				
	Female	96222 A	98444 A	95444 A	94555
	Male	J 2340	J 2340	J 2340	J 2290
2.	Plant height (cm)	190-195	180-190	155-165	200-210
3.	Effective tillers per plant	3-4	3-4	4-6	3-5
4.	Maturity days	80-85	76-80	75-78	80-85
5.	Reaction to Downey mildew disease	Resistant	Resistant	Resistant	Resistant
6.	Average yield (kg ha^{-1})	5037	2857	4389	4449

Table.1 Meteorological data recorded for the period of experiment at Sardarkrushinagar during 2012

Month and Year	Std. Week	Dates	Temperature (^{o}C)		Relative Humidity (%)		Wind velocity (km hr^{-1})	Bright sunshine hours	Rainfall (mm)
			Max.	Min.	Morn.	Even.			
Feb. 2012	05	29-4	26.6	5.9	71	31	6.6	9.6	0.0
	06	5-11	23.8	5.9	57	20	11.9	9.8	0.0
	07	12-18	27.6	10.9	60	21	9.0	9.4	0.0
	08	19-25	30.4	11.6	71	19	5.3	9.7	0.0
March 2012	09	26-3	30.7	11.7	70	20	7.8	10.2	0.0
	10	4-10	30.7	12.2	72	18	6.1	9.1	0.0
	11	11-17	32.8	12.3	62	15	4.7	9.6	0.0
	12	18-24	35.8	15.6	66	17	4.3	8.0	0.0
	13	25-31	38.4	17.7	73	22	3.5	8.6	0.0
April 2012	14	1-7	40.4	21.1	62	16	3.9	9.0	0.0
	15	8-14	38.8	21.1	70	24	6.4	9.0	0.0
	16	15-21	37.1	21.7	66	24	5.7	8.9	0.0
	17	22-28	36.6	21.5	64	27	4.6	10.5	0.0
May 2012	18	29-5	39.3	22.2	63	23	5.2	10.4	0.0
	19	6-12	38.5	24.7	78	35	6.0	10.2	0.0
	20	13-19	39.0	25.5	78	38	7.4	9.9	0.0
	21	20-26	40.2	24.9	86	32	7.3	10.5	0.0
June 2012	22	27-2	40.2	24.9	77	36	8.8	8.7	0.0
	23	3-9	38.6	26.5	74	38	12.8	5.3	0.0
	24	10-16	38.3	26.3	78	45	8.2	8.8	38.0
	25	17-23	38.0	26.7	80	42	14.2	7.7	0.0

Table.2 Plant height at 30, 60 DAS and at harvest (cm) as influenced by different hybrids

Treatments	Plant height (cm)		
	At 30 DAS	At 60 DAS	At harvest
V_1 :GHB 732	69.82	142.5	189.3
V_2 :GHB 744	69.01	138.3	185.3
V_3 :GHB 538	63.68	132.0	161.6
V_4 :GHB 558	69.97	146.4	192.9
S.Em.±	1.74	1.60	1.79
C. D. at 5 %	NS	4.65	5.20
C. V. (%)	8.85	3.97	3.41

Table.3 Tillers per plant at harvest as influenced by different hybrids

Treatments	Tillers per plant at harvest	
	Effective tillers	Total tillers
V_1 :GHB 732	4.41	5.62
V_2 :GHB 744	4.09	5.13
V_3 :GHB 538	4.29	5.38
V_4 :GHB 558	4.63	5.87
S.Em.±	0.093	0.113
C. D. at 5 %	0.27	0.32
C. V. (%)	7.42	7.13

Table.4 Length and girth of ear head of pearl millet at harvest as influenced by different hybrids

Treatments	Length of ear head (cm)	Girth of ear head (cm)
V_1 :GHB 732	23.70	10.53
V_2 :GHB 744	22.04	9.83
V_3 :GHB 538	22.62	10.32
V_4 :GHB 558	26.09	10.79
S.Em.±	0.540	0.223
C. D. at 5 %	1.56	0.64
C. V. (%)	7.92	7.45

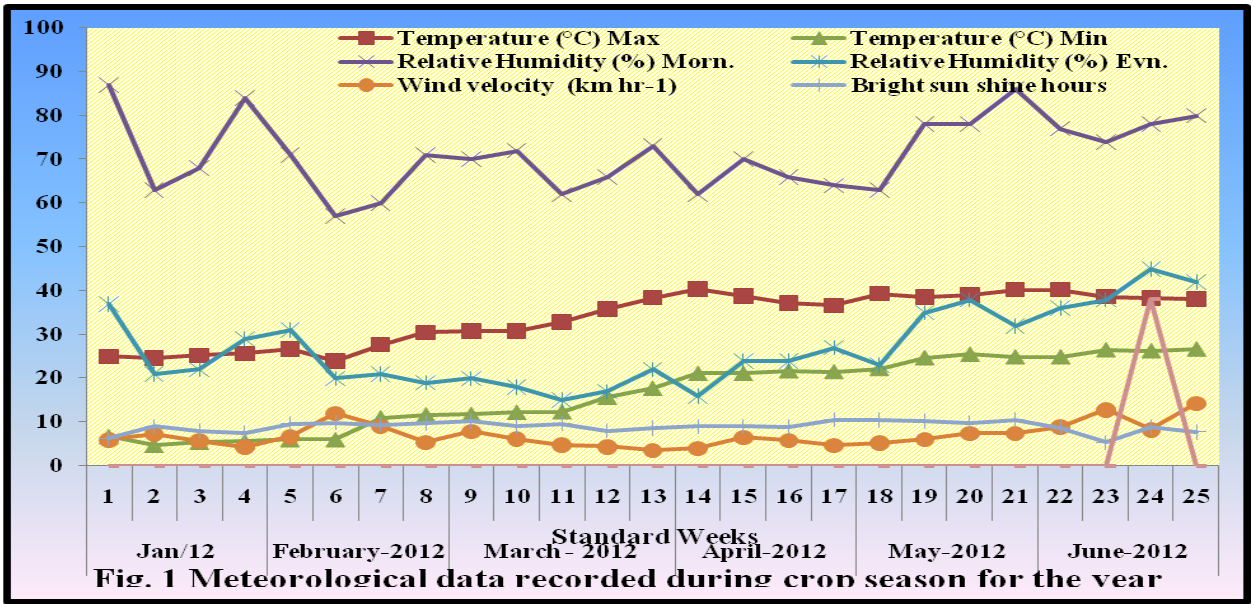
Table.5 Grain weight per plant (g) and 1000-grain weight (g) of pearl millet as influenced by different hybrids

Treatments	Grain weight per plant (g) at harvest	(1000-grain weight)
V_1 :GHB 732	48.06	9.55
V_2 :GHB 744	42.82	9.15
V_3 :GHB 538	45.98	9.40
V_4 :GHB 558	52.25	9.93
S.Em.±	1.19	0.156
C. D. at 5 %	3.47	0.454
C. V. (%)	8.77	5.71

Table.6 Grain yield and straw yield of pearl millet as influenced by different hybrids

Treatments	Grain yield (kg ha^{-1})	Dry fodder yield (kg ha^{-1})
V_1 :GHB 732	4676	9154
V_2 :GHB 744	3946	7894
V_3 :GHB 538	4276	8575
V_4 :GHB 558	4969	9720
S.Em.±	102	196
C. D. at 5 %	295	569
C. V. (%)	7.89	7.68

Fig.1 Meteorological data recorded for the period of experiment at Sardarkrushinagar during 2012



Differential observations were recorded in case of effective tillers per plant among different hybrids. Hybrid GHB 558 recorded higher effective tillers per plant than those under GHB 732, GHB 538 and GHB 744 hybrids. This increase was attributed to the genetically constituent of hybrid GHB 558 (Table 3). Similar findings were also recorded by Patel (1976), Patel (1988), and Patel (1995).

The data presented in Table 4 showed that hybrids have their individual effects on length of ear head. Hybrid GHB 558 recorded numerically longer ear heads than those under GHB 732, GHB 538 and GHB 744 hybrids. The less differences noted were due to genetical make-up of the hybrid. The results are in agreement with those reported by Jadav and Patel (1977), Varma (1986), Patel (1988), Dalshaniya

The data presented in Table 4 showed that hybrids have their individual effects on girth of ear head. Hybrid GHB 558 recorded remarkably higher girth of ear head than those under GHB 732, GHB 538 and GHB 744 hybrids. The differences noted were due to genetical make-up of the hybrids. Similar results were also reported by Bagada and Patel (1983) and Dalshaniya (1993).

From the data presented on 1000-grain weight, hybrid GHB 558 recorded higher 1000-grain weight than those under GHB 732, GHB 538 and GHB 744 hybrids. This might be attributed to bolder grain produced by GHB 558 hybrid. These finding was substantiated Patel (1981), Bagada and Patel (1983), Varma (1986),

Data pertaining to grain yield per plant and grain yield (Table 5) as influenced by different hybrids showed significant superiority of GHB 558 over that of GHB 732, GHB 538 and GHB 744 hybrids. These increases in case of grain yield per plant were attributed to higher values for length and girth of ear head recorded under GHB 558. The increase in grain yield was also due to higher values for all the yield attributes *viz.*, effective tillers per plant, length and girth of ear head and grain weight per plant recorded under GHB 558. Results pertaining to grain yield per plant are in agreement with those reported by Bagada and Patel (1983) and in case of grain yield reported by Singh and Singh (1971), Dalshaniya (1993) and Patel (1995).

From the data of dry fodder yield (Table 6) as influenced by different hybrids, it appeared that GHB 558 surpassed GHB 732, GHB 538 and GHB 744 hybrids, the increase in dry fodder yield of GHB 558 was owing to significant increase in plant height (Table 2). The present results are akin to those obtained Patel (1995).

From the foregoing discussion, it is concluded that pearl millet hybrid GHB 558 should be grown for securing maximum grain yield and net realization with higher BCR. Pearl millet crop should be sown on 2nd March for maximum grain and dry fodder yields as well as net realization and BCR under North Gujarat conditions.

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