International Journal of Plant & Soil Science

Volume 35, Issue 15, Page 145-150, 2023; Article no.IJPSS.97648
ISSN: 2320-7035

Effect of Spacing and Hybrid on Quality of Summer Pearl Millet (*Pennisetum glaucum* L.) under South Gujarat Condition

N. A. Patel [a], A. D. Raj [a*], V. Surve [a], P. M. Sankhala [a] and V. T. Parmar [a]

[a] Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari-396450, Gujarat, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i153090

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/97648

Original Research Article

Received: 18/01/2023
Accepted: 23/03/2023
Published: 10/06/2023

ABSTRACT

A field experiment conducted during summer season 2018 on College Farm, Navsari Agricultural University, Navsari on heavy black soil consisting nine treatments combinations were laid out in Randomized block design with factorial concept with four replications. The results revealed that the highest yield and net return of summer pearl millet was obtained with row spacing 45 × 15 cm or 60 × 15 cm along with hybrid GHB – 732 or GHB –558. Sowing of pearl millet at 45 × 15 cm row spacing showed significantly higher protein yield (508.85 kg/ha), grain yield (4775 kg/ha), straw yield (7828 kg/ha), nutrients uptake by grain and straw and maximum net realization of Rs.81295/ha with BCR of 3.07. The hybrid GHB-732 gave significantly higher protein yield (498.75 kg/ha), grain yield (4579 kg/ha), straw yield (7536 kg/ha), nutrients (N and K) uptake and total uptake by grain and straw and maximum net realization of Rs.77014/ha with highest BCR 2.91.

**Corresponding author: E-mail: adraj@nau.in;*

Keywords: Pearl millet; hybrids; row spacing; yield; quality; nutrient content and uptake.

1. INTRODUCTION

Pearl millet is commonly known as Bajri or Bajra in India. It is also known as 'bull rush millet', originated in tropical western Africa, where the greatest number of both wild ancestors and cultivated forms occur. It belongs to family gramineae (poaceae). In India, it is annually grown on 7.12 million ha area producing nearly 8.06 million tonnes of grains with productivity of 1132 kg/ha [1] and Gujarat occupies an area of 7 lakh ha and production of 12 lakh tones with productivity of 1,868 kg/ha [2]. The nutritive value of pearl millet is fairly high and it is fairly rich in fat content as compared to other cereals and imparts substantial energy to the body with good digestibility.

Row spacing is one of the most important factors affecting crop productivity. The optimum row spacing varies depending on genotypes or environmental factors such as soil fertility, moisture supply and sowing time. It also has the higher leaf photosynthesis and suppresses weeds growth compared with wider row spacing. 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. Keeping all these points in view, the present research work entitled "Effect of spacing and hybrid on quality of summer pearl millet (*Pennisetum glaucum* L.) under south Gujarat condition" was conducted.

2. MATERIALS AND METHODS

The field experiment was conducted at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during summer 2018. Normally, the summer season commences from the middle of February and ends by the middle of June. The weekly mean maximum and minimum temperature varied from 30.90 C to 37.30 C and 14.10 C to 26.70 C, respectively during the course of investigation. The relative humidity ranged from 76.5 to 92.8 per cent at morning and 22.4 to 66.4 per cent at evening. Bright sunshine hours per day were in the range of 5.7 to 11.1 during the crop period. The soil of experimental field was clay in texture, low in available nitrogen, medium in available phosphorus and high in available potassium. The soil was slightly alkaline in reaction with normal electrical conductivity. Total nine treatment combinations consisting of three treatments of hybrid (H_1: GHB – 538, H_2: GHB – 558 and H_3: GHB – 732) and three treatments of spacing (S_1: 30 x 15 cm, S_2: 45 x 15 cm and S_3: 60 x 15 cm) were evaluated in factorial RBD with four replications. The crop was sown with 3.75 kg/ha seed rate at different row spacing and different hybrid with line sowing method. The fertilizer dose used throughout experiment was 120-60-00 NPK kg/ha, wherein full dose of phosphorus (60 kg/ha) and half dose of nitrogen (60 kg/ha) was applied as basal just prior to sowing in the form of SSP and Urea. The remaining half dose of nitrogen (60 kg/ha) was applied in the form of urea as top dressed at 35 DAS.

3. RESULTS AND DISCUSSION

3.1 Effect of Row Spacing

3.3.1 Yield

The result pertaining to yield (Table 1) showed that grain and straw yield of pearl millet were influenced significantly due to different row spacing. Significantly higher grain yield (4775 kg/ha) and straw yield (7828 kg/ha) found under treatment S_2 (45 × 15 cm) over treatment S_1 (30 × 15 cm), but it was at par with S_3 (60 × 15 cm). This might be due to fact that proper row spacing or plant population might be attributed to minimum intra-species competition in crop plants and proper utilization of natural resources i.e. space, light, moisture and nutrients which might have remained underutilized due to mutual plant competition developed by more plants in closer row spacing. These results are also in agreement with finding of Rathore [3]. The effect of different row spacing was found non-significant on harvest index, but it was numerically the maximum in treatment S_2 (45 × 15 cm).

3.1.2 Quality parameters

Different treatment of row spacing on pearl millet crop did not produced significant effect on protein content in grain, but it was significantly affected on protein yield (Table - 1). Significantly higher protein yield (508.85 kg/ha) was produced by treatment S_2 (45 × 15 cm) but it was remained at par with treatment S_3 (60 × 15 cm). The increase in protein yield is mainly due to increase in grain yield. These similar result found by Rathore et al. [3].

3.1.3 Nutrient content and uptake

An appraisal of data given in Table 2 revealed that different row spacing was not significantly

influenced on N, P and K content in grain and straw. The result in Table 2 showed that treatment S_2 (45 × 15 cm) recorded significantly higher nutrients (N, P and K) uptake and total uptake (Table 3) by grain and straw than narrow S_1 (30 × 15 cm) and wider S_3 (60 × 15 cm) row spacing. These increase in N uptake by grain and straw due to cumulative effect of increased grain and straw yield. Thus there is an increase of nutrient uptake by grain and straw findings in accordance with those of Singh et al. [4].

3.1.4 Available nutrient in soil after harvest

The different treatment of row spacing were influenced non- significant effect on available N , available P_2O_5 and available K_2O in the soil after harvest of pearl millet crop (Table 3). The row spacing were influenced non- significant effect on available N, available P_2O_5 and available K_2O in the soil after harvest of pearl millet crop However, the highest available N (178.55 kg ha^{-1}), available P_2O_5 (32.31 kg ha^{-1}) and available K_2O (343.86 kg ha^{-1}) in soil was recorded by 30 × 15, 60 x 15 and 30 x 15 cm row spacing, respectively. Those result are in agreement with by Prakash [5].

3.1.5 Economics

The result presented in Table 1 indicated that the treatment S_2 (45 × 15 cm) was found superior by recording the maximum net realization of Rs.81295/ha with BCR of 3.07. The treatment S_1 (30 × 15 cm) produced the minimum net realization of Rs.52492 /ha with BCR of 1.98. It is obvious that realization of higher net returns and benefit: cost (B: C) ratio was the result of higher productivity of pearl millet under S_2 (45 × 15 cm) treatment. These results are in agreement with finding of Rathore [3].

3.2 Effect of Hybrids

3.2.1 Yield

The data presented in Table 1 indicated that significantly higher grain yield (4579 kg/ha) and straw yield (7536 kg/ha) were recorded by hybrid H_3 (GHB - 732), but it was remained at par with hybrid H_2 (GHB - 558). These increases in case of grain yield was also due to higher value for yield attributes *viz*., ear head length, ear head girth, 1000 seed weight and grain weight per ear head. Straw yield which owing to significant increase of number of total tillers per plant and plant height. Similar results were also reported by Gupta et al. [6]. Harvest Index was found non-significant among different pearl millet hybrids.

3.2.2 Quality parameters

The data presented in Table 1 showed that the treatment of pearl millet hybrids on crop did not produced significant effect on protein content in grain, but it was significantly affected on protein yield. Significantly higher protein yield (498.75 kg/ha) was produced by hybrid H_3 (GHB - 732) but it was remained at par with hybrid H_2 (GHB - 558). The increase in protein yield is mainly due to increase the grain yield. The similar result finding is agreement with finding of Rathore et al. [3].

3.2.3 Nutrient content and uptake

The data given in Table 2 revealed that different hybrids were not significantly influenced on N, P and K content in grain and straw. The result in Table 2 showed that hybrid H_3 (GHB - 732) was recorded significantly maximum nutrients N and K uptake by grain and total uptake (Table 3) by grain and straw. These increase in N uptake by grain and N uptake by straw due to cumulative effect of increase in grain yield and straw yield. The results are in accordance with those reported by Yamank et al. [7].

3.2.4 Available nutrient in soil after harvest

The treatment of different pearl millet hybrids influenced non-significant effect on available N , available P_2O_5 and available K_2O in the soil after harvest of pearl millet crop. The pearl millet hybrids influenced non-significant effect on available N, available P_2O_5 and available K_2O in the soil after harvest of pearl millet crop. However, the highest available N (176.80 kg ha^{-1}), available P_2O_5 (32.27 kg ha^{-1}) and available K_2O (339.37 kg ha^{-1}) in soil was recorded by hybrid GHB -538 and GHB – 732 and GHB-732, respectively This similar result obtained by Sannagoudar et al. [8]

3.2.5 Economics

The result presented in Table 1 indicated that hybrid H_3 (GHB - 732) was found superior by recording the maximum net returns Rs.77014/ha with BCR 2.91, while hybrid H_1 (GHB - 538) recorded the minimum value of net realization Rs.63933/ha with BCR 2.42. It is obvious that realization of higher net returns and benefit: cost (B: C) ratio was the result of higher productivity. These results are in agreement with finding of Chaudhari et al. [9].

Table 1. Effect of hybrids and row spacing on quality parameter, yield and economics on summer pearl millet

Treatments	Protein content (%)	Protein yield (kg/ha)	Yield (kg/ha)		Gross realization (₹/ha)	Total cost of cultivation (₹/ha)	Net realization (₹/ha)	B: C ratio
			Grain	Straw				
Row Spacing (S)								
S_1: 30 × 15 cm	10.58	371.07	3500	5749	78997	26505	52492	1.98
S_2: 45 × 15 cm	10.67	508.85	4775	7829	107722	26427	81295	3.07
S_3: 60 × 15 cm	10.81	487.06	4500	7392	101566	26278	75288	2.87
S.Em.±	0.16	17.20	-	-	-	-	-	-
C.D. at 5 %	NS	50.22	-	-	-	-	-	-
Hybrids (H)								
H_1: GHB – 538	10.57	422.92	4008	6552	90337	26403	63933	2.42
H_2: GHB – 558	10.62	445.32	4188	6881	94531	26403	68128	2.58
H_3: GHB – 732	10.87	498.75	4579	7537	103417	26403	77014	2.91
S.Em.±	0.16	17.20	-	-	-	-	-	-
C.D. at 5 %	NS	50.22	-	-	-	-	-	-

Table 2. Nutrient content and uptake by summer pearl grain and straw millet as influenced by hybrids and different row spacing

Treatments	N, P and K content (%)						N, P and K uptake (kg/ha)					
	Grain			straw			Grain			straw		
	N	P	K	N	P	K	N	P	K	N	P	K
Row Spacing (S)												
S_1: 30 × 15 cm	1.69	0.334	0.685	0.702	0.083	0.837	59.37	11.70	24.04	40.44	4.80	48.13
S_2: 45 × 15 cm	1.70	0.336	0.693	0.719	0.085	0.843	81.41	16.06	33.03	56.38	6.67	66.03
S_3: 60 × 15 cm	1.72	0.341	0.705	0.723	0.087	0.850	77.93	15.40	31.77	53.49	6.53	62.88
S.Em.±	0.03	0.004	0.009	0.009	0.001	0.011	2.75	0.59	1.06	2.06	0.25	2.35
C.D. at 5 %	NS	NS	NS	NS	NS	NS	8.03	1.74	3.11	6.01	0.75	6.85
Hybrids (H)												
H_1: GHB – 538	1.69	0.336	0.692	0.708	0.085	0.843	67.66	13.48	27.78	46.47	6.00	55.20
H_2: GHB – 558	1.70	0.337	0.692	0.719	0.086	0.842	71.25	14.13	28.91	49.66	6.56	58.06
H_3: GHB – 732	1.74	0.339	0.700	0.717	0.001	0.019	79.80	15.54	32.13	54.18	7.05	63.79
S.Em.±	0.03	0.004	0.009	0.009	0.001	0.011	2.75	0.59	1.06	2.06	0.25	2.35
C.D. at 5 %	NS	NS	NS	NS	NS	NS	8.03	NS	3.11	6.01	NS	NS
Interaction (S x H)												
S.Em.±	0.05	0.007	0.016	0.017	0.001	0.019	4.79	1.03	1.84	3.57	0.39	4.07
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	5.38	4.26	4.78	4.66	4.50	4.71	13.08	14.39	12.46	14.24	13.46	13.79

Table 3. Total nutrient uptake by summer pearl millet grain and straw and available nutrients after harvesting as influenced by hybrids and different row spacing

Treatments	Total uptake (kg/ha)			Available nutrients in soil (kg/ha)		
	N	P	K	N	P_2O_5	K_2O
Row Spacing (S)						
S_1: 30 × 15 cm	99.81	16.51	72.15	178.55	31.61	343.86
S_2: 45 × 15 cm	137.80	22.73	99.07	174.58	32.11	334.43
S_3: 60 × 15 cm	131.42	21.93	94.66	173.59	32.31	331.49
S.Em.±	4.57	0.80	3.30	3.94	0.77	7.33
C.D. at 5 %	13..36	2.35	9.63	NS	NS	NS
Hybrids (H)						
H_1: GHB – 538	114.11	19.41	82.99	176.80	31.88	336.09
H_2: GHB – 558	120.91	20.12	86.97	174.20	31.88	334.31
H_3: GHB – 732	133.99	21.95	95.92	175.72	32.27	339.37
S.Em.±	4.57	0.80	3.30	3.94	0.77	7.33
C.D. at 5 %	13.36	NS	9.63	NS	NS	NS
Interaction (S x H)						
S.Em.±	7.93	1.39	5.71	6.83	0.86	12.70
C.D. at 5 %	NS	NS	NS	NS	NS	NS
C.V. %	12.89	13.71	12.90	7.78	8.36	7.55

4. CONCLUSION

The highest yield, net realization and BCR can be obtained from summer pearl millet through sowing of hybrid GHB – 732 or GHB – 558 ta at row spacing 45 × 15 cm or 66 × 15 cm in south Gujarat heavy rainfall Agro-ecological situation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Agriculture statistics at a glance 2014, Ministry of Agriculture. Government of India; 2014.
2. Anonymous. Pearl millet News, AICRP on pearl millet, ICAR Mandor, Jodhpur, Rajasthan. India. 2017;6:1-8.
3. Chaudhari RP, Patel PM, Patel BM, Kumar U, Darji SS, Patel SJ. Performance of summer pearl-millet (*Pennisetum glaucum* L.) hybrids under North Gujarat Conditions. International Journal of Currrent Microbioogy Applied Science. 2018;7(1): 637-644.
4. Gupta A. Sharma OP, Yadav SS, Solanki RB. Correlation studies in pearl millet as influenced by varieties and bio-regulators. The Pharma Innovation Journal. 2017; 6(2):176-178.
5. Prakash C. Effect of fertility levels and plant population on leaf area, productivity and quality of pearlmillet hybrids (*Pennisetum glaucum* L.) under dryland condition. Ph.D.Thesis submitted to Banaras Hindu University, Varanasi; 2014.
6. Rathore BS, Rana VS, Nanwal RV. Effect of plant density and fertility levels on growth and yield of pearl millet (*Pennisetum glaucum* L.) hybrids under limited irrigation conditions in semi arid environment. Indian Journal of Agricultural Sciences. 2009;78(8):667-670.
7. Sannagoudar MS, Lalitha BS, Prajwal Kumar GK, Prashant, Bhavya V. Effect of varieties, cutting and nitrogen management on green fodder yield, nutrient uptake, available soil nutrient status and economics of dual purpose pearl millet (*Pennisetum glaucumn* L.) International Journal of Current Microbiolgy and Applied Sciences. 2017;6(12): 214-226.
8. Singh Narender, Midha LK, Prasad, Dasharathnath, Asha Ram, Vandana, Singh, Parmeshwer. Effect of spacing and nitrogen levels on nutrient contents and their uptake in hybrid Pearl millet. Journal of Progressive Agriculture. 2013;4(1):85-86.
9. Yamank, Sewhag M, Malik P, Babli. Influence of inorganic fertilizers and biomix inoculation combination on NPK content and uptake in grain and stover of pearl millet hybrids, International Journal of Pure and Applied Bioscience. 2017;5(5):553-557.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/97648