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Short Research Article

Fodder Potential of Pearl Millet Forage Hybrids under Rainfed Conditions of Gujarat

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Abstract

Field experiments were conducted during *kharif* 2014, to know the performance of 29 crosses of pearl millet forage under rainfed conditions of Gujarat. Significant differences were observed among the hybrids for days to 50% flowering, days to maturity, plant height, plant population, grain yield, dry fodder yield and green fodder yield. The locations differences were found significant for all the characters except plant population and dry fodder yield. Days to 50% flowering ranged from 48 (ICMA 10999×HHVBC tall) to 65 days (check PAC 981). ICMA 07999×HHHVBC tall (181 cm) was the shortest, while, check DFMH 70 (308 cm) was the tallest hybrid. ICMA 00999×IP 6202 produced the maximum dry fodder yield (138 q ha^{-1}) among all the crosses followed by ICMA 01888×ICMV 05222 (129 q ha^{-1}) and check ICMV 08111 (119 q ha^{-1}). The cross ICMA 00999×IP 6202 produced the highest green fodder yield (262 q ha^{-1}) among all the crosses followed by ICMA 01888×ICMV 05222 (250 q ha^{-1}) and check ICMV 08111 (233 q ha^{-1}). The hybrids ICMA 00999×IP 6202 and ICMA 01888×ICMV 05222 recorded high green fodder yield, dry fodder yield and plant height than the best check ICMV 08111. Thus, these two hybrids may be considered for general cultivation under rain fed conditions of Gujarat.

1. Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is an indispensable source of fodder in many regions of the world (Bhatnagar et al., 1998). Being a C_4 species, it has tremendous potential for biomass production, most of which is accumulated in its vegetative parts. Shashikala et al. (2013) mentioned that the green fodder of pearl millet is leafy, palatable and very nutritious feed stock for cattle ensuring good milk yield. Being any time forage, pearl millet, unlike sorghum, can be grazed, or cut and fed at any growth stage, as it has no HCN content. Pearl millet is excellent for producing silage, particularly in regions with dry spells during the rainy season. Pearl millet can produce higher silage yields with higher protein than sorghum. Pearl millet is high tolerance to high temperature and better ability to with stand drought and to grow even under low soil fertility is best suited for arid and semi arid conditions of Gujarat. Its green fodder is a valuable feed for livestock. The production potential of green fodder of pearl millet at present is however, low. Obviously if productivity of the animal population has to be improved, high fodder yielding varieties hybrids^{-1} of pearl millet need to be developed. Heterosis is well established for forage production in pearl millet. Verma and Katiyar (1977) reported 134% ha are among 171 forage hybrids grown at two locations. The greatest opportunity for increasing forage productivity of Pearl millet is through the development of hybrids. Burton (1962) released the first pearl millet forage hybrid, Gahi 1, which yielded 52% more dry matter than Common and 35% more than Starr. Burton (1977) another released pearl millet forage hybrid, Gahi 3, which was the first hybrid based on CMS basis. Therefore, the objective of the present study was to identify promising forage hybrids of pearl millet for green fodder yield and its component traits under rain fed conditions of Gujarat.

2. Materials and Methods

Two seed set of 29 hybrids of pearl millet forage (Table 1) including six checks viz., ICMV 05555, ICMV 08111, DFMH 70, DFMH 88, DFMH 30 and PAC 981 were supplied by ICRISAT, Patancheru, Hyderabad. Field experiments were conducted at Pearl millet Research Station, Junagadh Agricultural University (JAU), Jamnagar and Grassland Research Station, JAU, Dhari, during rainy season of 2014. The design of the trail was randomization complete block design with two replications at both the locations. Each plot

consisted of four rows of 4.0 m long and 60 cm a part in both locations. Middle two rows were considered for all the observations. Thus, the net plot size was 4.0×1.20 m^2. The trial was planted on 24th July, 2014 and 25th July, 2014 at Jamnagar and Dhari centre, respectively. While, the trial was harvested on 30th October, 2014 and 10th November, 2014 at Jamnagar and Dhari centre, respectively. The crop was supplied with recommended dose of fertilizer 80-40-00 NPK kg ha^{-1} at both locations. Observations on days to 50% flowering, days to maturity, plant height (cm), plant population $plot^{-1}$, grain yield (kg $plot^{-1}$), dry stalk yield (kg $plot^{-1}$) and fresh stalk yield (kg $plot^{-1}$) were recorded. Days to 50% flowering and days to maturity was recorded on plot basis. The data of grain yield, dry stalk yield (dry fodder yield) and green stalk yield (green fodder yield) from net plot were recorded and computed as in q ha^{-1}; and plant population were converted into hectare basis. Statistical analysis was carried out following procedures of Panse and Sukhatme (1978).

3. Results and Discussion

The results presented in Table 1 revealed that the pearl millet forage hybrids differed significantly for days to 50% flowering, days to maturity, plant height, plant population, grain yield, dry fodder yield and green fodder yield at Jamnagar, and for days to maturity and plant height at Dhari, whereas it was significant for all the traits under studied pooled over locations. Hybrids differences were non-significant for days to 50% flowering, plant population, grain yield, dry fodder yield and green fodder yield at Dhari. The locations differences were significant for all the characters except plant population and dry fodder yield. Hybrids×locations differences were non-significant for all the characters under studied except days to maturity. Days to 50% flowering ranged from 44 (ICMA 07999×HHVBC tall) to 66 days (check PAC 981) at Jamnagar, whereas, it was varied from 50 (ICMA 10999 × HHVBC tall) to 65 days (ICMA 01888×ICMV 05222, check PAC 981) at Dhari. ICMA 10999×HHVBC tall was the earliest flowered (48 days), while check PAC 981was the latest flowered (65 days) amongst all the hybrids over the locations. Hybrid ICMA 10999×HHVBC tall depicted as the earliest flowered amongst all the hybrids at Dhari and over the locations. Days to maturity varied from 76 (ICMA 10999×HHVBC tall) to 93 days (check PAC 981) at Jamnagar. ICMA 10999×HHVBC tall was the earliest maturing hybrid (69 days), while, the checks ICMV 05555 and PAC 981 were the lateness (90 days) amongst all the hybrids at Dhari. Days to maturity ranged from 73 (ICMA 10999×HHVBC tall) to 92 days (check PAC 981) pooled over locations. Hybrid ICMA 10999×HHVBC tall was the earliest maturing, while, check PAC 981 was the lateness in maturing amongst all the hybrids at Jamnagar, Dhari and over locations. The highest plant height recorded in check DFMH 70 (281 cm) amongst all the hybrids followed by check ICMV 08111 (273 cm), ICMA 01888×ICMV 05222 (271 cm) and ICMA 00999×IP 6202 (267 cm); while, the lowest plant height observed in ICMA 07999×HHVBC tall (175 cm) at Jamnagar. ICMA 01888×ICMV 05222 was the tallest having a plant height of 338 cm followed by check DFMH 70 (335 cm) and ICMA 00999×IP 6202 (318 cm); while, the minimum plant height depicted in ICMA 07999×HHVBC tall (188 cm) at Dhari. Plant height ranged from 181 (ICMA 07999×HHVBC tall) to 308 cm (check DFMH 70) pooled over the locations. ICMA 07999×HHVBC tall was the shortest at Jamnagar, Dhari and over locations. It is interesting to note that the tall crosses were, in general, produced high green as well as dry fodder yield. The minimum number of plant ha^{-1} (plant population) was recorded in ICMA 07999×ICMV 05555 (52083) at Jamnagar, in ICMA 03222×IP 15564 (60417) at Dhari, and in ICMA 03222×IP 15564 (63542) pooled over the locations. Whereas, the maximum number of plant ha^{-1} was counted in ICMA 10999×IP 11431 (119791, 118750 and 119271) at Jamnagar, Dhari and pooled over the locations, respectively. Hybrid ICMA 01888×IP 6140 produced the highest grain yield (25.84 q ha^{-1}) among all the crosses followed by checks DFMH 88 (25.11 q ha^{-1}) and DFMH 70 (24.90 q ha^{-1}) at Jamnagar. The check ICMV 08111 recorded the lowest grain yield (8.28 q ha^{-1}) at Jamnagar. The grain yield ranged from 6.09 (check ICMV 05555) to 27.57 q ha^{-1} (check DFMH 88) at Dhari. The check DFMH 88 (26.34 q ha^{-1}) ranked top in grain yield among all the hybrids followed by check DFMH 70 (22.77 q ha^{-1}) and ICMA 01888×IP 6140 (20.22 q ha^{-1}) pooled over locations. The check ICMV 05555 produced the lowest grain yield (7.97 q ha^{-1}) among all the crosses pooled over locations. ICMA 00999×IP 6202 produced the maximum dry fodder yield (137 q ha^{-1}) among all the hybrids followed by ICMA 01888×ICMV 05222 (127 q ha^{-1}) and check ICMV 08111 (125 q ha^{-1}) at Jamnagar. The hybrid ICMA 07999×HHVBC tall produced the lowest dry fodder yield (34 q ha^{-1}) at Jamnagar. Dry fodder yield ranged from 53 (ICMA 09888×HHVBC tall) to 139 q ha^{-1} (ICMA 00999×IP 6202) at Dhari. The cross ICMA 00999×IP 6202 produced the highest dry fodder yield (138 q ha^{-1}) among all the crosses followed by ICMA 01888×ICMV 05222 (129 q ha^{-1}) and check ICMV 08111 (119 q ha^{-1}) over the locations. The hybrid ICMA 07999×HHVBC tal produced the lowest dry fodder yield (54 q ha^{-1}) pooled over the locations. ICMA 00999×IP 6202 produced the maximum dry fodder yield at Jamnagar, Dhari and pooled over locations, which was also reflected tall hybrid at Jamnagar, Dhari and pooled over locations. The cross ICMA 00999×IP 6202 (269 q ha^{-1}) ranked top in green fodder yield among all the crosses followed by check ICMV 08111 (258 q ha^{-1}) and ICMA 01888×ICMV

Table 1: Performance of pearl millet forage hybrids for different parameters at Jamnagar, Dhari and pooled over locations during rainy season of 2014

Sr. no.	Hybrids	Days to 50% flowering			Days to maturity			Plant height (cm)			Plant population ha^{-1}			Grain yield (q ha^{-1})			Dry fodder yield (q ha^{-1})			Green fodder yield (q ha^{-1})		
		J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P
1.	ICMA 00444× IP 11431	57	61	59	85	85	85	235	270	252	61458	79167	70312	14.69	18.04	16.37	75	76	76	180	125	153
2.	ICMA 00444× IP 13150	50	53	51	81	76	78	239	265	252	87500	89583	88542	19.07	15.63	17.35	77	109	93	191	239	215
3.	ICMA 00444× IP 6202	56	53	54	83	82	82	241	280	261	77083	95833	86458	17.24	15.92	16.58	93	72	83	216	133	175
4.	ICMA 00999× IP 6202	63	64	63	88	89	88	267	318	293	98958	77083	88021	10.53	18.56	14.55	137	139	138	269	255	262
5.	ICMA 01888× ICMV 05222	61	65	63	86	83	84	271	338	305	94792	83333	89062	19.06	12.96	16.01	127	130	129	250	249	250
6.	ICMA 01888×IP 22269	56	61	59	84	78	81	255	270	263	88542	77083	82812	15.78	19.17	17.48	78	64	71	198	131	164
7.	ICMA 01888×IP 6140	60	61	60	86	81	83	279	303	291	118750	95833	107291	25.84	14.60	20.22	86	74	80	218	136	177
8.	ICMA 03222× ICMV 05777	60	59	59	87	83	85	242	315	278	97917	83333	90625	14.95	15.69	15.32	89	92	90	198	173	186
9.	ICMA 03222×IP 15564	61	63	62	88	81	84	249	308	278	66667	60417	63542	21.20	14.90	18.05	84	78	81	184	155	170
10.	ICMA 03333× ICMV 05555	47	59	53	78	73	75	187	220	204	65625	87500	76562	14.27	14.21	14.24	68	74	71	167	142	154

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Sr. no.	Hybrids	Days to 50% flowering			Days to maturity			Plant height (cm)			Plant population ha^{-1}			Grain yield (q ha^{-1})			Dry fodder yield (q ha^{-1})			Green fodder yield (q ha^{-1})		
		J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P
11.	ICMA 03333× ICMV 05666	48	59	53	78	70	74	179	213	196	63542	83333	73437	15.11	12.28	13.70	77	95	86	199	176	187
12.	ICMA 03333× IP 13150	50	58	54	78	73	76	205	205	205	70833	100000	85417	18.39	18.08	18.24	57	86	72	157	158	158
13.	ICMA 07999× HHVBC tall	44	55	50	76	71	74	175	188	181	69792	81250	75521	13.13	7.62	10.38	34	74	54	104	110	107
14.	ICMA 07999× ICMV 05555	47	51	49	78	70	74	184	208	196	52083	75024	63554	15.63	13.55	14.59	48	71	59	130	162	146
15.	ICMA 07999× ICMV 08111	47	57	52	76	76	76	236	235	236	112500	95833	104167	20.73	11.57	16.15	84	83	84	209	171	190
16.	ICMA 09888× HHVBC tall	48	56	52	77	76	76	228	263	246	92708	77083	84896	19.33	9.96	14.65	73	53	63	197	117	157
17.	ICMA 09888× ICMV 05555	51	59	55	85	78	82	250	273	261	91667	81250	86458	16.36	17.75	17.06	91	65	78	217	115	166
18.	ICMA 09888× ICMV 08111	52	58	55	81	73	77	246	278	262	90625	89583	90104	20.37	14.46	17.42	106	91	99	235	174	205
19.	ICMA 09888× IP 11431	58	59	58	87	86	86	256	303	280	104167	91667	97917	18.75	12.14	15.45	105	103	104	232	202	217

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Sr. no.	Hybrids	Days to 50% flowering			Days to maturity			Plant height (cm)			Plant population ha^{-1}			Grain yield (q ha^{-1})			Dry fodder yield (q ha^{-1})			Green fodder yield (q ha^{-1})		
		J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P	J	D	P
20.	ICMA 09888×IP 13150	54	55	54	84	80	82	251	300	275	105208	77083	91146	18.02	13.85	15.94	87	98	92	168	203	186
21.	ICMA 09888×IP 22269	57	63	60	87	80	84	265	320	293	89583	79167	84375	17.66	13.68	15.67	112	110	111	219	215	217
22.	ICMA 10999×HH-VBC tal	46	50	48	76	69	73	222	228	225	103125	108333	105729	16.41	14.06	15.24	57	60	59	136	124	130
23.	ICMA 10999× IP 11431	61	63	62	86	76	81	256	243	250	119791	118750	119271	18.81	13.36	16.09	69	71	70	157	121	139
24.	ICMV 05555 (C)	62	58	60	90	90	90	255	305	280	91667	100000	95833	9.85	6.09	7.97	113	104	109	230	187	209
25.	ICMV 08111 (C)	65	61	63	92	89	90	273	315	294	89583	95833	92708	8.28	7.76	8.02	125	113	119	258	207	233
26.	DFMH 70 (C)	57	58	57	86	78	82	281	335	308	106250	93750	100000	24.90	20.63	22.77	110	91	100	231	166	199
27.	DFMH 88 (C)	59	58	58	84	84	84	253	323	288	88542	95833	92187	25.11	27.57	26.34	89	77	83	200	235	218
28.	DFMH 30 (C)	49	53	51	77	71	74	234	270	252	113541	93750	103646	14.59	14.74	14.67	90	117	104	218	234	226
29.	PAC 981 (C)	66	65	65	93	90	92	222	293	258	103125	85417	94271	16.15	20.06	18.11	98	105	102	194	209	201
Mean		55	58	57	83	79	81	239	276	258	90194	88004	89099	17.25	14.79	16.02	87	88	88	199	172	185
Hybrids (H), SEm+		0.84	4.23	2.20	0.92	3.13	2.47	9.38	20.82	11.37	10255	9378	7317	2.46	4.15	2.35	7.92	18.4	9.55	17.3	38.6	20.8
CD (p=0.05)		2.43	NS	6.19	2.66	9.06	7.14	27.11	60.14	32.03	29629	NS	20614	7.10	NS	6.61	22.9	NS	26.9	49.9	NS	58.5
Location (L), SEm+		-	-	0.57	-	-	0.43	-	-	3.00	-	-	1825	-	-	0.63	-	-	2.63	-	-	5.55
CD (p=0.05)		-	-	3.24	-	-	2.44	-	-	17.04	-	-	NS	-	-	3.58	-	-	NS	-	-	31.6
H×L, SEm+		-	-	3.05	-	-	2.31	-	-	16.15	-	-	9826	-	-	3.41	-	-	14.2	-	-	29.9
CD (p=0.05)		-	-	NS	-	-	6.54	-	-	NS	-	-	NS	-	-	NS	-	-	NS	-	-	NS

Where: J=Jamnagar centre, D=Dhari centre, P=Pooled data, NS=non-significant.

05222 (250 q ha^{-1}) at Jamnagar. ICMA 07999×HHVBC tall depicted the lowest green fodder yield (104 q ha^{-1}) among all the crosses at Jamnagar. ICMA 00999×IP 6202 produced the highest green fodder yield (255 q ha^{-1}) among all the hybrids followed by ICMA 01888×ICMV 05222 (249 q ha^{-1}) and ICMA 00444×IP 13150 (239 q ha^{-1}) at Dhari. Green fodder yield varied from 110 (ICMA 07999×HHVBC tall) to 255 q ha^{-1} (ICMA 00999×IP 6202) at Dhari. The cross ICMA 00999×IP 6202 produced the maximum green fodder yield (262 q ha^{-1}) among all the crosses followed by ICMA 01888×ICMV 05222 (250 q ha^{-1}) and check ICMV 08111 (233 q ha^{-1}) pooled over the locations. The cross ICMA 07999×HHVBC tall produced the minimum green fodder yield at Jamnagar (104 q ha^{-1}), at Dhari (110 q ha^{-1}) and pooled over the locations (107 q ha^{-1}) among all the crosses. The crosses ICMA 00999×IP 6202 (262 q ha^{-1}) and ICMA 01888×ICMV 05222 (250 q ha^{-1}) produced the higher green fodder yield than the best check ICMV 08111 (233 q ha^{-1}) pooled over the locations. These two crosses also recorded high dry fodder yield and plant height at Jamnagar, Dhari and pooled over the locations. Similarly, genotypic variations in forage pearl millet were reported by Mohammad et al. (1994); Naeem et al. (2002, 2003); Khan et al. (2004); Chohan et al. (2006); Hassan et al. (2014).

4. Conclusion

Significant variation was found among the pearl millet crosses for the characters studied. The crosses ICMA 00999×IP 6202 and ICMA 01888×ICMV 05222 recorded high green fodder yield, dry fodder yield and plant height than the best check ICMV 08111. Thus, these two hybrids may be considered for general cultivation under rain fed conditions of Gujarat.

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