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Research Article

Morphological and Yield Response of Pearl Millet (*Pennisetum Glaucum L.*) as Influenced by Different Accessions and Cutting Management under Saline Irrigation Water in North Western Region of India

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Abstract

A experiment was carried out in 2015 under Factorial RBD with treatments consisting 20 pearl millet accession and 2 cutting management [C_1-Single cut at 50 DAS for green fodder and left for grain purpose, C2-three cut for green fodder purpose at 50, 80 and 110 DAS] under saline irrigation water (EC~6dS m^{-1}). Irrespective of cutting management ICFH -15, ICFH -16, ICFH -17 recorded significantly highest value for plant height, Number of leaves, tillers, stem girth, fodder yield, net return and benefit cost ratio than rest others. Among cutting management treatment C_1 (for dual purpose) proved superior in comparison to C_2 (Multicut purpose). Therefore, our results suggest that accession ICFH -15, ICFH -16, ICFH -17 for dual purpose might be adapted as a strategy for getting higher Green fodder yield under saline environment in north-western region of India and elsewhere under similar agro-climatic conditions.

Keywords: Pearlmillet accessions, cutting management, Fodder

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Introduction

India sustains about 15% (512.05 million) of the world's livestock population [1], 17% of world human population over 2.3% of world geographical area and 4.2% of world's water resources [2]. Livestock production is backbone of Indian agriculture contributing 7% shares to national GDP and source of employment for 16.44 million workers [3], and ultimate livelihood for 70% population, most of the marginal and sub marginal farmers especially in rural areas [4]. Country ranks first in terms of milk production with the amount of 155.5 million tonnes [3]; however, the productivity of our animals is hardly 40-60% of world's average productivity. The lower productivity of animals under Indian condition mainly accounted due to deficit supply of green fodder besides good quality of feed, fodder, poor health care and management. Country has only 4.4 per cent of the cultivated area under fodder crops with an annual total forage production of 833 million tons (390 and 443 mt green and dry fodder respectively). Whereas, the annual forage requirement is 1594 million tons (1025 and 569 mt green and dry respectively) to support the existing livestock population [5]. Thus presently, the country faces a net deficit of 63% green fodder, 24% dry crop residues and 64% feeds [2].To meet out the deficit, green forage supply has to grow at 1.69% annually [5]. In India, due to increased population pressure and competition from the food crops for natural resources like land, water, sunlight etc., therefore it is not possible to increase the area under fodder crops further. Abiotic stresses resulting from water deficit, high salinity, and drought are identified as major causes which adversely affect yield and quality of cultivated crops as well as forage crops [6]. Among aforesaid factors, soil salinity mainly accounted in terms of poor quality water is an aggravating problem for agriculture, adversely affecting the performance of crop including forages, especially those cultivated in arid and semiarid regions of world [7 and 8]. Therefore, inadequate supply of good quality water for irrigation is a major factor limiting factor. In the back drop of this alarming scenario for supply of good quality water and to ensure food and fodder with better quality to the burgeoning human and animal population, agriculture sector has no alternative other than to safe use of poor quality water for augmenting irrigation requirement. Thus gap between demand and supply may be narrowed down through cultivation of quick growing, high yielding and salinity tolerant fodder crops for ensuring good quality fodder for livestock through effective use of poor quality water as assured supply of irrigation under dark zone of the world (Arid and semi-arid areas of the globe where salinity is the major cause for lower crop production). Another possibility is through exploring the opportunities for better utilization of existing farming systems, utilizing marginal, sub marginal dry lands and problematic soils for developing fodder resources. Simultaneously efforts should be made in the genetic improvement of the livestock for better utilization of available fodder for most effectively, identification and introduction of new high yielding non-traditional crops for green fodder and strategies to develop and adopt dual type grain-cum-fodder crop varieties to cater the demand of grain and fodder with available land resource. In this context, Pearl millet (*Pennisetum glaucum* L.) is a promising dual purpose (fodder and grain), short duration, quick growing crop with good salinity tolerant characteristics, therefore has an advantage over others cultivated fodder in salt affected areas [9, 10, 11 and 12]. Being any time forage, with high tillering ability, high protein content (10-12%) and ratoon ability, unlike sorghum, can be grazed, or cut and fed at any growth stage, as it has no HCN content, thus making it as an outstanding fodder crop in present required situations [13]. Majority of recommended fodder pearlmillet varieties were evolved and released based on their single cut performance, but now the farmers are habituated to go for 2-3 cuts in according to their need. Hybrids that have multicut potential with improved quality and high herbage yield may help in this context. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), is a pioneer research institute continuous working for explore the genotypic variability of vegetative-stage salinity and drought tolerance. ICRISAT has collected more than 21000 accessions of pearlmillet having landraces and breeders' products. These accessions revealed considerable variability for various fodder and quality components such plant height, leaf to stem ratio, number of leaves, tillers, protein, dry matter and mineral content. Therefore, present study was conducted to assess the production potential of 20 Pearl millet accessions derived from ICRISAT with two cutting management (as dual and multicut purpose) under saline irrigation water.

Material and Methods

This study was carried out at ICAR-Central Soil Salinity Research Institute Experimental farm, Nain (29°19' N, 76°47'E and 230.5 m above the mean sea level), Panipat, Haryana, India. The climate of the area is semi-arid with a mean annual rainfall of 678 mm, 70-80% of which is received during the months of July-September. The mean minimum, maximum temperature and total rainfall during this study was 13.9°C, 34.3°C and 523 mm, respectively. Highest relative humidity (~100%) was recorded on 10^{th}, 11^{th}, 17^{th} August and 4^{th} November, whereas the lowest relative humidity (~27%) was recorded on 23^{th} October during 43^{th} week of study. In addition to total rainfall, supplemental irrigations of saline water (EC 6.0 dS/m) were applied at 1.2 ID/CPE to meet the crop water requirement throughout the growing period. The experiment was conducted in Factorial RBD with three replications. Treatments under study were 20 pearl millet accessions (ICFH 1 to 20) to access their fodder production potential in two cutting management i.e. for dual purpose (C_1-cutting at 50 and 110 DAS for grain) and for multicut (C_2-cutting at 50, 80 and 110 DAS). The soil of experimental site was sandy loam in texture with 8.3 pH, Walkley–Black C (0.30%), ECe(6.65 dS/m), KMnO4 oxidizable N (130.4 kg/ha), 0.5 M NaHCO3 extractable P(11.6 kg/ha) and 1 NH4OAC extractable K (248.4 kg/ha). Seed rate12 kg ha^{-1} and Row spacing: 30 cm×10 cm was adopted under this study. A common dose of nutrients amounting 120 kg N + 60 kg P_2O_5 + 40 kg K_2O were applied in all treatments. The $1/3^{rd}$ N and whole P_2O5 and K_2O was applied as basal, while remaining $2/3^{rd}$ N was top dressed as urea in two equal splits at 1^{st} cutting and 30 days after 1^{st} cutting. In view of best weed management, all the plots were manually weeded as per the requirement during the complete crop cycle. The biometric observations were recorded with tagged plant in each plot and numbers of plant population were counted one meter row length. All data recorded were analyzed with the help of analysis of variance (ANOVA) technique [14] for Factorial RBD. The least significant test was used to decipher the main and interaction effects of treatments at 5% level of significance ($P<0.05$).

Results and Discussion

Plant height (PH)

It is apparent from (**Table 1**), that significant variations were observed in PH only due to accessions at 50 and 80 DAS. The maximum plant height was observed in ICFH-15(186.50 cm and 120.93 cm) followed by ICFH-16 (176.00 cm and 114.29 cm) and minimum in ICFH-7 (87.79 cm and 54.52 cm) at 50 and 80 DAS, respectively. At 110 DAS, PH was affected due both main effect of cutting management, accessions and their interaction. The interaction between accession and cutting management corroborated that ICFH-16 (185.83 cm) gave maximum height at C_1 and accession ICFH-03 at C_2 (129.92 cm). The significant interaction effect between accessions and cutting management may be due to differential genetic make of accession, which could be responsible for variation in rattoon ability and ultimately differential response at different cutting management. Significant higher PH was noted in C_1 (144.21 cm) in comparison to C_2 (88.75 cm), this may be attributed to the fact that in C_1 more time was available for growth than C_2. Similar, results for PH in forage pearl millet were reported by [10; 15; 16; 17 and 18].

Table 1 Plant height (cm) and Numbers of leaves/plant of pearl millet as influenced by accessions and cutting management

Treatment VxC	50 DAS			80 DAS			110 DAS		
	C1	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**
Plant height									
ICFH-1	126.25	126.30	126.28	83.00	79.45	81.23	110.00	121.58	115.79
ICFH-2	115.47	117.88	116.68	69.03	67.11	68.07	106.44	109.92	108.18
ICFH-3	135.25	129.30	132.28	83.22	83.49	83.36	132.61	129.92	131.27
ICFH-4	109.60	108.66	109.13	65.61	60.39	63.00	83.00	112.00	97.50
ICFH-5	120.67	113.83	117.25	66.17	65.61	65.89	127.61	81.25	104.43
ICFH-6	139.50	163.33	151.42	109.35	112.00	110.68	144.22	78.50	111.36
ICFH-7	89.75	85.83	87.79	56.28	52.76	54.52	123.64	52.58	88.11
ICFH-8	124.95	122.33	123.64	71.47	69.71	70.59	139.44	60.42	99.93
ICFH-9	126.42	122.66	124.54	74.22	69.99	72.11	136.61	70.75	103.68
ICFH-10	135.33	152.60	143.97	95.41	99.36	97.39	162.06	105.25	133.66
ICFH-11	135.60	139.00	137.30	86.01	85.38	85.70	153.78	74.33	114.06
ICFH-12	132.67	142.66	137.67	90.62	95.17	92.90	141.78	87.17	114.48
ICFH-13	135.60	136.00	135.80	84.94	84.98	84.96	146.80	92.17	119.49
ICFH-14	153.00	143.00	148.00	95.27	98.00	96.64	153.11	66.58	109.85
ICFH-15	185.00	188.00	186.50	119.13	122.73	120.93	174.22	107.92	141.07
ICFH-16	173.50	178.50	176.00	110.00	118.57	114.29	185.83	102.00	143.92
ICFH-17	156.67	156.00	156.34	96.35	100.18	98.27	175.72	95.58	135.65
ICFH-18	158.00	162.50	160.25	106.76	108.17	107.47	173.11	98.00	135.56
ICFH-19	165.00	157.00	161.00	99.84	105.99	102.92	163.67	82.17	122.92
ICFH-20	152.00	140.40	146.20	86.80	90.19	88.50	150.56	47.00	98.78
Mean	138.51	139.29		87.47	88.46		144.21	88.75	
Factor	C	V	CxV	C	V	CxV	C	V	CxV
SEm±	2.35	7.44	3.56	1.18	3.72	5.26	1.10	3.47	4.91
CD (P=0.05)	NS	14.81	NS	NS	7.41	NS	2.18	6.91	9.77
Numbers of leaves/plant									
ICFH-1	75.77	77.28	76.53	46.11	60.96	53.54	42.00	98.00	70.00
ICFH-2	72.21	71.55	71.88	42.44	40.67	41.56	39.89	58.00	48.95
ICFH-3	81.40	78.06	79.73	50.67	62.22	56.45	51.56	112.00	81.78
ICFH-4	67.45	66.78	67.12	31.22	38.52	34.87	36.78	58.67	47.73
ICFH-5	72.30	69.18	70.74	34.11	40.37	37.24	48.00	42.67	45.34
ICFH-6	93.63	112.00	102.82	97.89	95.67	96.78	64.11	42.67	53.39
ICFH-7	66.98	66.31	66.65	30.22	34.67	32.45	47.89	27.67	37.78
ICFH-8	75.25	71.64	73.45	42.78	55.74	49.26	60.44	29.00	44.72
ICFH-9	77.94	75.10	76.52	44.11	58.33	51.22	54.44	33.67	44.06
ICFH-10	83.00	98.00	90.50	74.22	75.48	74.85	83.00	57.00	70.00
ICFH-11	91.30	90.64	90.97	58.22	64.81	61.52	78.88	36.67	57.78
ICFH-12	78.73	94.77	86.75	66.78	68.00	67.39	60.89	44.80	52.85
ICFH-13	87.47	86.81	87.14	56.56	62.52	59.54	64.44	45.00	54.72
ICFH-14	100.01	95.18	97.60	71.89	71.93	71.91	77.22	31.50	54.36
ICFH-15	122.95	122.29	122.62	110.00	112.00	111.00	105.22	57.67	81.45
ICFH-16	112.68	112.01	112.35	107.89	98.00	102.95	112.33	54.67	83.50
ICFH-17	100.04	99.35	99.70	82.33	87.67	85.00	110.00	45.50	77.75
ICFH-18	100.62	99.96	100.29	96.89	93.78	95.34	99.78	47.00	73.39
ICFH-19	110.00	99.38	104.69	83.00	88.44	85.72	87.22	43.33	65.28
ICFH-20	95.85	92.96	94.41	60.00	65.48	62.74	71.56	26.83	49.20
Mean	88.28	88.96		64.37	68.76		69.78	49.62	
Factor	C	V	CxV	C	V	CxV	C	V	CxV
SEm±	3.77	11.93	16.87	4.01	12.70	17.95	3.55	11.24	15.90
CD (P=0.05)	NS	23.75	NS	NS	25.27	NS	7.08	22.38	NS

Table 2 Number of tillers/plant and stem girth (cm) of pearl millet as influenced by accessions and cutting management

Treatment VxC	50 DAS			80 DAS			110 DAS		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
Number of tillers/plant									
ICFH-1	12.28	13.18	12.73	10.31	9.94	10.13	6.72	8.94	7.83
ICFH-2	11.97	12.23	12.10	9.70	9.58	9.64	6.72	7.61	7.17
ICFH-3	12.47	13.19	12.83	10.75	10.12	10.44	7.66	9.97	10.32
ICFH-4	11.80	11.93	11.87	9.38	9.00	9.19	6.41	7.78	7.10
ICFH-5	11.98	12.09	12.04	9.65	9.26	9.46	8.53	5.69	6.61
ICFH-6	14.01	17.21	15.61	12.18	12.18	12.18	8.66	5.67	7.17
ICFH-7	11.70	11.56	11.63	8.83	7.96	8.40	7.08	5.28	6.18
ICFH-8	12.09	12.27	12.18	9.72	9.59	9.66	7.91	5.53	6.72
ICFH-9	12.45	12.71	12.58	9.95	9.78	9.87	7.72	5.61	6.67
ICFH-10	13.27	15.19	14.23	11.68	11.57	11.63	9.39	7.50	8.45
ICFH-11	13.56	13.27	13.42	11.2	10.39	10.8	9.36	5.64	7.50
ICFH-12	12.46	13.95	13.21	11.61	11.00	11.31	8.19	5.92	7.06
ICFH-13	13.50	13.23	13.37	11.02	10.37	10.70	8.72	6.06	7.39
ICFH-14	15.47	15.14	15.31	11.62	11.37	11.50	9.28	5.56	7.42
ICFH-15	18.93	17.79	18.36	16.90	13.73	15.32	10.53	7.56	9.05
ICFH-16	17.96	17.73	17.85	13.02	12.47	12.75	11.00	6.50	10.75
ICFH-17	15.55	15.52	15.54	11.79	11.66	11.73	10.39	6.31	9.35
ICFH-18	16.37	16.47	16.42	12.16	12.07	12.12	10.08	6.33	8.21
ICFH-19	16.44	15.85	16.15	12.00	11.96	11.98	9.50	5.78	7.64
ICFH-20	14.78	13.74	14.26	11.34	10.47	10.91	8.86	4.61	6.74
Mean	13.95	14.21		11.24	10.72		8.89	6.49	
Factor	C	V	CxV	C	V	CxV	C	V	CxV
SEm±	0.40	1.27	1.80	0.31	0.99	1.41	0.31	0.98	1.38
CD (P=0.05)	NS	2.54	NS	NS	1.98	NS	0.61	1.94	NS
Stem girth									
ICFH-1	4.76	5.26	5.01	3.20	4.00	3.60	3.16	4.43	3.80
ICFH-2	4.37	4.57	4.47	2.56	3.12	2.84	3.04	4.25	3.65
ICFH-3	4.99	5.30	5.15	3.29	4.01	3.65	3.99	4.46	4.23
ICFH-4	4.13	4.04	4.09	2.13	2.47	2.30	2.94	4.28	3.61
ICFH-5	4.47	4.42	4.45	2.41	2.63	2.52	3.50	3.29	3.40
ICFH-6	5.66	7.50	6.58	4.99	5.50	5.25	4.50	3.11	3.81
ICFH-7	3.98	3.87	3.93	1.72	2.27	2.00	3.40	2.66	3.03
ICFH-8	4.62	4.73	4.68	2.61	3.70	3.16	4.15	2.86	3.51
ICFH-9	4.79	5.16	4.98	2.98	3.83	3.41	4.03	3.06	3.55
ICFH-10	5.13	6.14	5.64	4.35	4.67	4.51	4.68	3.88	4.28
ICFH-11	5.38	5.38	5.38	3.87	4.20	4.04	4.61	3.10	3.86
ICFH-12	4.86	5.72	5.29	3.90	4.41	4.16	4.23	3.46	3.85
ICFH-13	5.37	5.37	5.37	3.68	4.20	3.94	4.56	3.49	4.03
ICFH-14	5.78	5.73	5.76	4.15	4.43	4.29	4.58	2.98	3.78
ICFH-15	6.08	8.57	7.33	5.72	6.33	6.03	5.44	4.07	4.76
ICFH-16	6.00	7.93	6.97	5.18	6.12	5.65	5.92	3.78	4.85
ICFH-17	5.97	6.27	6.12	4.36	5.00	4.68	5.61	3.60	4.61
ICFH-18	5.97	6.60	6.29	4.70	5.37	5.04	5.22	3.62	4.42
ICFH-19	5.99	6.42	6.21	4.47	5.20	4.84	4.68	3.45	4.07
ICFH-20	5.71	5.71	5.71	3.87	4.40	4.14	4.56	2.46	3.51
Mean	5.20	5.73		3.71	4.29		4.34	3.51	
Factor	C	V	CxV	C	V	CxV	C	V	CxV
SEm±	0.22	0.69	0.97	0.24	0.75	1.06	0.11	0.34	0.48
CD (P=0.05)	NS	1.37	NS	NS	1.49	NS	0.21	0.67	0.95

Number of leaves per plant (NOL)

Our results (Table 1) indicated that NOL at different cutting management were affected by both accessions and cutting management. However, at 50 and 80 DAS, NOL were significantly influenced only by different accessions. The maximum number of leaves per plant were observed in ICFH-15(122.62 and 111.00) followed by ICFH-16(112.35 and 102.95) and minimum in ICFH-7 (66.65 and 32.45) at 50 and 80 DAS, respectively. At 110 DAS, NOL were affected by cutting management, potential of accessions and there interaction. ICFH-15 recorded the highest value (112.33) for this parameter. The variations among accession might be due to differential genetic make-up. The accession in which significantly lower numbers of leaves observed might have inability to cope up with the higher load of salt under saline irrigation water, which restricted the root growth of plants that in turn reduced the uptake of water and nutrients leading to decreased leaf emerging rate as well as leafiness of plant. Significantly higher NOL were recorded in C_1 (69.78) in comparison to C_2 (49.62). This was mainly due to more opportune time for growth, higher plant height and nos. of internodes in C_1 as compared C_2. Our results are supported with the findings of previous study [19 and 20] for genotypic variations for number of leaves in forage pearlmillet.

Number of tiller per plant (NOT)

The perusal of data on NOT is presented in **Table 2**. It is explicit from the data that NOT per plant were altered due to accessions and cutting management at different intervals. Cutting management did not affected number of tillers per plant at 50 and 80 DAS, however, significant variations at these two stages were observed due to accessions. The maximum number of tillers per plant was observed in ICFH-15(18.36 and 15.32) followed by ICFH-16(17.85 and 12.75) and minimum in ICFH-7 (11.63 and 8.40) at 50 and 80 DAS, respectively. At 110 DAS, number of tillers per plant was affected due to both cutting management and different accessions. Significantly higher NOT was noted in C_1 (8.89) in comparison to C_2 (6.49).This could be due to higher time span availability for growth, photosynthesis and translocation of food material for plant functioning which, leads in higher rate of assimilate accumulation as different plant organ development such as tillers. At this stage of 110 DAS, accession number ICFH-16 recorded highest NOT (10.75) and ICFH-7 produced least numbers (6.18). The differential physio-genetic characteristics of accessions might be reason for variability among accessions for number of tillers. Our results of variability for NOT under different cutting management are in close agreement with past findings [13; 17 and 21].

Stem girth

It can be inferred (from Table 2) that stem girth was influenced by both accessions and cutting management at different intervals. At 50 and 80 DAS, significant variations were observed only among different accessions. The maximum stem girth was observed in ICFH-15(7.33 cm and 6.03 cm) and minimum in ICFH-7 (3.93 cm and 2.00 cm) at 50 and 80 DAS, respectively. Stem girth at 110 DAS, was affected by both factors i.e. main effect of cutting and accessions and their interaction. Significant higher girth was found in C_1 (4.34 cm) in comparison to C_2 (3.51 cm), this might be attributed to the fact that in C_1 more time was available for growth than C_2. The interaction among accessions and cutting management was found significant and it may be due to differential genetic make to imparts different growth habits such as high ratoon ability for multi cut purpose and hardiness for grain cum fodder purpose. The accession ICFH-16 (5.92 cm) gave the maximum height at C_1 and accession ICFH-03 at C_2 (4.46 cm). Our results are in confirmative with the older findings [20 and 22].

Number of plants per meter row length (NOP)

It can be depicted from (**Table 3**) that NOP were not altered due to different accessions at all the stages of observations. Among cutting management treatments, number of plants per meter row length at 50 and 80 DAS were statistically at par, however, significant variations were observed at 110 DAS. In C_1 cutting management significantly the maximum NOP (8.80) were recorded. The interaction between accessions and cutting management was also found non-significant at all three stages. These findings are supported by previous researchers [16 and 20]

Green fodder yield

Data for green fodder yield at 50, 80 and 110 DAS are presented in Table 3. At 50 and 80 DAS, significant variations were observed only due to accessions. The maximum green fodder yield was observed in ICFH-15(40.86 t/ha) followed by ICFH-16(37.53 t/ha) and minimum in ICFH-7 (27.70 t/ha) at 50 DAS. While at 80 DAS, the maximum green fodder yield was observed in ICFH-03 (20.40 t/ha) followed by ICFH-04 (19.83 t/ha) and minimum in ICFH-19 (14.77 t/ha).

Table 3 Number of plants /meter row length (m.r.l.) and green fodder yield (t/ha) of pearl millet as influenced by accessions and cutting management

Treatment VxC	50 DAS			80 DAS			110 DAS		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
Number of plants									
ICFH-1	12.28	13.18	12.73	10.31	9.94	10.13	6.72	8.94	7.83
ICFH-2	11.97	12.23	12.10	9.70	9.58	9.64	6.72	7.61	7.17
ICFH-3	12.47	13.19	12.83	10.75	10.12	10.44	7.66	9.97	10.32
ICFH-4	11.80	11.93	11.87	9.38	9.00	9.19	6.41	7.78	7.10
ICFH-5	11.98	12.09	12.04	9.65	9.26	9.46	8.53	5.69	6.61
ICFH-6	14.01	17.21	15.61	12.18	12.18	12.18	8.66	5.67	7.17
ICFH-7	11.70	11.56	11.63	8.83	7.96	8.40	7.08	5.28	6.18
ICFH-8	12.09	12.27	12.18	9.72	9.59	9.66	7.91	5.53	6.72
ICFH-9	12.45	12.71	12.58	9.95	9.78	9.87	7.72	5.61	6.67
ICFH-10	13.27	15.19	14.23	11.68	11.57	11.63	9.39	7.50	8.45
ICFH-11	13.56	13.27	13.42	11.2	10.39	10.8	9.36	5.64	7.50
ICFH-12	12.46	13.95	13.21	11.61	11.00	11.31	8.19	5.92	7.06
ICFH-13	13.50	13.23	13.37	11.02	10.37	10.70	8.72	6.06	7.39
ICFH-14	15.47	15.14	15.31	11.62	11.37	11.50	9.28	5.56	7.42
ICFH-15	18.93	17.79	18.36	16.90	13.73	15.32	10.53	7.56	9.05
ICFH-16	17.96	17.73	17.85	13.02	12.47	12.75	11.00	6.50	10.75
ICFH-17	15.55	15.52	15.54	11.79	11.66	11.73	10.39	6.31	9.35
ICFH-18	16.37	16.47	16.42	12.16	12.07	12.12	10.08	6.33	8.21
ICFH-19	16.44	15.85	16.15	12.00	11.96	11.98	9.50	5.78	7.64
ICFH-20	14.78	13.74	14.26	11.34	10.47	10.91	8.86	4.61	6.74
Mean	13.95	14.21		11.24	10.72		8.89	6.49	
Factor	C	V	CxV	C	V	CxV	C	V	CxV
SEm±	0.40	1.27	1.80	0.31	0.99	1.41	0.31	0.98	1.38
CD (P=0.05)	NS	2.54	NS	NS	1.98	NS	0.61	1.94	NS
Green fodder yield (t/ha)									
ICFH-1	30.45	30.94	30.70	19.49	25.13	13.33	55.58	63.77	59.67
ICFH-2	29.62	29.57	29.59	19.90	24.63	11.86	54.24	61.33	57.79
ICFH-3	32.49	32.03	32.26	20.40	26.35	13.78	58.85	66.21	62.53
ICFH-4	27.99	28.84	28.41	19.83	22.70	12.08	50.68	60.75	55.72
ICFH-5	29.67	29.32	29.50	18.39	26.32	8.26	55.99	55.97	55.98
ICFH-6	34.15	36.51	35.33	16.36	30.22	8.17	64.37	61.03	62.70
ICFH-7	27.06	28.34	27.70	16.23	25.29	6.61	52.34	51.18	51.76
ICFH-8	30.21	30.69	30.45	17.00	29.15	7.01	59.36	54.69	57.03
ICFH-9	31.26	30.79	31.02	15.14	28.95	7.96	60.21	53.89	57.05
ICFH-10	33.17	34.01	33.59	17.48	31.74	10.86	64.91	62.36	63.63
ICFH-11	33.43	33.04	33.24	15.51	31.63	7.97	65.07	56.53	60.80
ICFH-12	32.16	33.57	32.86	17.32	29.67	8.52	61.83	59.41	60.62
ICFH-13	33.28	32.83	33.06	16.74	30.97	8.64	64.26	58.20	61.23
ICFH-14	34.48	33.99	34.23	15.64	31.35	7.89	65.83	57.52	61.68
ICFH-15	40.63	41.09	40.86	18.43	32.99	11.59	73.61	66.12	69.87
ICFH-16	36.94	38.12	37.53	17.54	34.86	10.58	71.80	66.24	69.02
ICFH-17	35.29	34.51	34.90	14.99	34.09	8.99	69.38	58.49	63.93
ICFH-18	35.44	35.22	35.33	15.27	32.15	9.08	67.59	59.57	63.58
ICFH-19	35.97	34.60	35.29	14.77	31.83	8.50	67.80	57.87	62.84
ICFH-20	34.16	33.07	33.61	15.25	31.14	6.61	65.30	54.93	60.12
Mean	32.89	33.05					62.45	59.30	
Factor	C	V	CxV	V	V	V	C	V	CxV
SEm±	0.55	1.74	2.46	2.16	2.07	2.18	0.63	2.01	2.84
CD (P=0.05)	NS	3.46	NS	4.36	4.19	4.41	1.26	3.99	5.65

At 80 DAS in C_1, no green fodder yield was obtained due to treatment which resulted in lower average of total green fodder yields than first observation at C_2. At 110 DAS, green fodder yield was affected significantly due to different accessions and highest yield at C_1 was noted with ICFH-16 followed by ICFH-17 while at C_2 ICFH-03 followed by ICFH-01recorded the highest yield. Total green fodder yield was estimated by summation of yield obtained at each cutting and analyzed. Total green fodder yield was affected significantly due to both main effect of cutting management and accessions and their interactions. Significant higher green fodder yield was found in C_1 (62.45 t/ha) in comparison to C_2 (59.30 t/ha), this may be due to single cutting for green fodder and followed by harvest for grain purpose provided longer time-span for growth. Frequent cutting also reduces the possibility of photosynthesis and inhibits nutrient assimilation and reduces the carbohydrate reserve, which affects the biomass production of the plants and ultimately green fodder yield. The interaction between accessions and cutting management was found significant and it can be concluded that different accessions performed differentially to the cutting managements. The accession ICFH-15 (73.61t/ha) gave the maximum green fodder yield at C_1 and accession ICFH-16 at C_2 (66.24 t/ha).The differential response among the accessions for green fodder yield may be attributed due to variation in genetic make-up. Genotypic variation among accessions resulted in differential response for plant height, tillering pattern, leaf: stem ratio which leads to variation in green fodder yield. The accession in which Significantly lower green fodder yield noted might be due to inability to cope up with the higher load of salt under saline irrigation water which restricted the root growth of plants that in turn reduced the uptake of nutrients leading to leaf chlorosis that reduces the photosynthetic potential of crops which ultimately leads to lower green fodder yield. These findings are in agreements with results of [21; 23; 24; 25; 26 and 27].

Economics of production

The data on net returns and benefit cost ratio (B:C) as influenced by 2 cutting management level are presented in **Table 4**. The highest net return (₹75.43×10^3) and benefit cost (1.2) ratio was obtained with C_1 cutting management (Dual purpose or dual cut) in comparison to C_2 (triple cut or multicut). This could be due higher growth and yield of both grain as well as fodder yield with C_1 cutting management and lower cost of cultivation as one less harvesting. Highest net return (₹44.55×10^3) was obtained from ICFH 15 in comparison with all other accessions. Highest benefit cost ratio was obtained from ICFH 15 and 16 then rest of all other lines, whereas lowest was recorded from ICFH 7. ICFH-17 in C_1 cutting management and ICFH-16 in C_2 cutting management found superior than rest other accessions. These results are in conformity with the older study [28].

Table 4 Effect of accessions and cutting management on economics

Treatments	Net returns ($\times10^3$ ₹ /ha)			B: C Ratio		
	C_1	C_2	Mean	C_1	C_2	Mean
ICFH-1	39.32	22.77	31.04	0.96	0.56	0.76
ICFH-2	53.28	20.33	36.80	1.30	0.50	0.90
ICFH-3	36.21	25.21	30.71	0.88	0.61	0.75
ICFH-4	48.19	19.75	33.97	1.18	0.48	0.83
ICFH-5	52.99	14.97	33.98	1.29	0.37	0.83
ICFH-6	49.25	20.03	34.64	1.20	0.49	0.84
ICFH-7	42.45	10.18	26.32	1.04	0.25	0.64
ICFH-8	45.26	13.69	29.48	1.10	0.33	0.72
ICFH-9	34.64	12.89	23.76	0.84	0.31	0.58
ICFH-10	39.85	21.36	30.60	0.97	0.52	0.75
ICFH-11	58.88	15.53	37.20	1.44	0.38	0.91
ICFH-12	46.20	18.41	32.31	1.13	0.45	0.79
ICFH-13	40.60	17.20	28.90	0.99	0.42	0.70
ICFH-14	46.38	16.52	31.45	1.13	0.40	0.77
ICFH-15	63.98	25.12	44.55	1.56	0.61	1.09
ICFH-16	63.08	25.24	44.53	1.56	0.62	1.09
ICFH-17	68.42	17.49	42.95	1.67	0.43	1.05
ICFH-18	52.86	18.57	35.71	1.29	0.45	0.87
ICFH-19	47.46	16.87	32.16	1.16	0.41	0.78
ICFH-20	59.36	13.93	36.65	1.45	0.34	0.89
Mean	50.55	18.30	34.43	1.20	0.40	0.80

Conclusions

Our results suggest that ICFH -15, ICFH -16, ICFH -17 accession of pearlmillet with single cut for green fodder followed by harvest for grain purpose may be adapted as a choice for getting higher fodder yield as compare to other accessions and cutting management strategy under saline environment in north-western region of India and elsewhere under similar agro-climatic conditions.

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