Indian Res. J. Genet. & Biotech. 10(1): 134-138Feburary (2018)

Effect of bed planting technique on Pearl millet in saline water irrigation condition in semi-arid region Western part of Uttar Pradesh.

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(Received : December, 2017 : Revised : January, 2018; Accepted : January, 2018)

Abstract

A field experiment wasconducted during kharif seasons of 2012 and 2013 at the Research farm of AICRP- Management of Salt Affected Solis and Use of Saline Water in Agriculture, R.B.S.College, Bichpuri,(U.P). The treatment comprised of three levels of irrigation schedule viz.(0.9, 0.6 and 0.3) IW/CPE ratio, three levels of irrigation water salinity (BAW,8 and 12 dS/m) and two method of sowing bed sowing and traditional sowing (flat sowing method). The findings of present investigation indicated that the grain and stover yield as well as most of the growth and yield attributes of pearl millet were significantly influence due to different salinity levels and method of sowing. The results, further revealed that growth attributes such as plant height (cm), dry matter (gm), effective tillers plant^{-1}, ear length (cm), grain weight ear^{-1} (gm), grain yield plant^{-1} (gm) and test weight (gm) were significantly higher in bed method of sowing. The heights grain yield recorded in BAW irrigated treatments 23.8 q ha^{-1} in 2012 and 27.4 in 2013 in bed sowing method in IW/CPE ratio0.9. The same trend was observed in stover yield in both years in pearl millet crop.

Introduction

In India efforts to promote conservation Agriculture technologies have been focused in to Indo- Gangetic plains covering the sate of Panjab, Haryana, Uttar Pradesh, Bihar and West Bengal. Over the decades of seventies and eighties rice followed by wheat has emerged the major cropping system extending to over 10 million ha., although a number of other crops are grown in spatial and temporal variations thought the plains according to agro- climatic variations. Concern of stagnating productivity increasing production costs, decline resource quality, decline water table and increasing environmental problems are the major forcing factor to look for alternative technologies particularly in the north – west region encompassing the state of Panjab , Haryana an Western UP. In the eastern region covering eastern UP , Bihar and West Bangal developing and promoting strategies to overcome the constraints responsible for continued low cropping system productivity have been the main concern. Furrow irrigated raised bed system (FIRBS) technology is one such innovation, which can be of immense use in conserving resources particularly scarce water and reduction cost of production through efficient input usage like seed and fertilizer without any adverse effect on the productivity. The FIRB system of wheat cultivation have some advantages over conventional flat system with regards to saving of irrigation water, seed, fertilizer nitrogen, easier weed management and reduced loding. Among different cropping system, the raised bed system has greater efficiency of water and nutrient under different agro-climatic conditions.

MatarialsAnd Method

The experiment was conducted at the experimental farm of Raja Balwant Singh College, Bichpuri, Agra . The climate at the site is semi-arid with average rainfall of 650 mm, about 80% of which is received during July – September. The soil at the site was a well-drained (water level below 12m) sandy loam soil with an electrical conductivity of saturation paste extract (ECe) of 2.7 d S/m , Ph of the saturation paste (pHs) of 7.9, exchangeable sodium percentage (ESP) 5.3, Organic matter content of 2.9 g/kg soil and clay content of 14 %. The experiment with pearl millet – wheat crops grown in rotation was initiated during 2010 with pearl millet as the first crop and continued till the rabi season 2012-13. Treatments consisted of combination of irrigation with waters of three varying salinities viz. Best available water (BAW)

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Published by Indian Society of Genetics, Biotechnology Research and Development,
5, E Biotech Bhawan, Nikhil Estate, Mugalia Road, Shastripuram, Sikandra, Agra 282007
Online management by www.isgbrd.co.in

, ECiw 8 and 12 dS/m , three IW/CPE ratio (0.3, 0.6 and 0.9) and two method of sowing flat (conventional method of sowing) and bed method of sowing. Treatments were imposed in a factorial randomized block design with three replications. The plot size was 16 m^2 (4m x 4m) and to control lateral fluxes of salt and water, each plot was lined with polyethylene sheet down to a depth of 0.9 m. Saline water was synthesized by dissolving the required quantities of NaCl, Na_2So_4, $CaCl_2$ and $MgSo_4$ in available water. Local agronomic practices in term of inter/intra row spacing, seed rate, fertilizers, irrigation schedules and other cultural practices were followed for each crop. Pearl millet (MBH 163) was planted during the second week of July and harvested during the end of September and first week of October. The crop received 60, 60 and 40 kg /ha of fertilizer nitrogen, phosphorus and potash, respectively. . The rain fall received during the pearl millet seasons averaged 342.2, respectively. The IW/CPE ratio did not apply in pearl millet seasons. The flat sowing method depth of irrigation 7 cm and bed sowing this was 4 cm.

Results and discussion:

The growth and yield attributing characters of pearl millet crop was observed i.e. germination (%), plant height (cm), dry matter accumulation (g), effective tillers per plant, ear length (cm), grain weight per ear (g), grain yield per plant (g) and test weight (g) and presented in table1.The water salinity of irrigation water differ significantly in all the characters of Perl millet crop. All these characters significantly higher in BAW (best available water) treatment and lowest in ECiw-12 dS/m salinity water irrigation treatments. The IW/CPE ratio did not differ significant because this treatment not applicable in rainy season. The method o sowing was also differing significantly in all the growth and yield attributing characters. The bed sowing method was superior compared with flat method of sowing same results has been reported by Chauhan et al.2011, Chauhan, 2007 and Chauhan et al, 2009.

Crop yield:

Being rainy season crop, the irrigation schedules (IW/CPE ratio) could not be applied due to intermitted rains. The treatment effect viz. method of sowing and water salinity levels could only be compared. The water salinity significantly declined the grain yield in pearl millet crop growing in year 2012 and 2013. The significant reduction was recorded at ECiw 12 dS/m within about 1.68 % in 2012 and 8.75 % in 2013 compared with BAW (Table 2). The same results show in Stover yield of pearl millet crop in both years (Table 2). Amongst the method of sowing, the bed sowing method increased the grain yield of pearl millet crop significant over flat method of sowingin two years experimentation, and quantum of increase was 10.6 % in 2012 and 9.4 % in 2013, respectively.The some other workersgiven the same resultsKim.et al.2004, Kumpawat, 1998 and Mehrvar and Asadi 2006.

Table 1: Growth and yield attributing characteristics of pearl millet in different treatments (AV. 2 years)

Treatments	Germination (%)	Plant Height (cm)	Dry matter (gm)	Effective Tillers/m	Ear Length (cm)	Grain weight/ Ear(gm)	Grain Yield/ Plant(gm)	Test Weight (gm)
Salinity levels (d S/m)								
BAW	84.6	162.1	59.0	1.33	28.0	8.6	26.2	7.7
8	80.5	154.9	56.4	1.26	26.4	8.2	24.7	6.8
12	73.4	149.7	53.6	1.21	24.6	8.1	22.7	6.5
CD at 5%	2.0	2.6	1.7	0.08	1.2	0.3	0.9	0.2
IW/CPE ratio								
0.3	78.7	156.9	56.6	1.28	26.6	8.1	24.8	7.0
0.6	78.8	157.0	56.9	1.28	26.6	8.2	25.1	7.1
0.9	78.6	157.4	57.2	1.30	26.7	8.4	25.1	6.5
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS
Method of sowing								
Flat	78.8	151.3	43.9	1.16	24.6	7.2	22.7	6.7
BED	81.6	157.3	57.2	1.30	26.7	8.6	25.1	7.9
CD at 5%	1.5	5.5	1.9	0.05	1.0	0.4	0.9	0.2

Table 2 :Effect of different treatments on grain yield of Pearl millet (qha^{-1})

ECiw (dS/m)	Method of sowing/ IW/CPE ratios				
	Surface	Bed sowing method			Averages
	0.9	0.9	0.6	0.3	
2012					
BAW	21.9	23.9	23.9	23.5	23.8
ECiw 8	21.4	23.9	23.8	23.5	23.7
ECiw 12	21.2	23.7	23.3	23.4	23.4
Average	21.5	23.8	23.6	23.4	
CD at 5 %	Method for 0.9 IW/CPE ratio only = 0.6				
	ECiw (surface) = NS ECiw (Bed) = NS , IW/CPE ratio = NS				
	Interaction IW/CPE ratio = NS				
2013					
BAW	26.6	28.5	27.8	27.2	27.8
ECiw 8	23.8	27.1	26.9	26.1	26.7
ECiw 12	22.2	25.8	24.9	24.3	25.0
Average	24.1	27.1	26.5	25.9	-
CD at 5 %	Method for 0.9 IW/CPE ratio only = 1.9				
	ECiw (surface) = 2.4 ECiw (Bed) = 1.5 , IW/CPE ratio = NS				
	Interaction IW/CPE ratio = NS				

Table 2: Effect of different treatments on Stover yield of Pearl millet (q ha^{-1})

ECiw (dS/m)	Method of sowing/ IW/CPE ratios				
	Surface	Bed sowing method			Averages
	0.9	0.9	0.6	0.3	
2012					
BAW	94.4	100.1	101.8	100.8	100.8
ECiw 8	92.5	101.8	101.2	99.9	100.9
ECiw 12	92.5	101.0	100.7	99.4	100.4
Average	93.1	100.9	101.2	100.0	-
CD at 5 %	Method for 0.9 IW/CPE ratio only = 1.3				
	ECiw (surface) = NS ECiw (Bed) = NS , IW/CPE ratio = NS				
	Interaction IW/CPE ratio = NS				
2013					
BAW	87.1	92.1	91.1	90.3	91.2
ECiw 8	70.3	85.6	85.5	83.7	84.9
ECiw 12	62.8	70.7	70.5	69.9	70.4
Average	73.4	82.8	82.4	81.3	-
CD at 5 %	Method for 0.9 IW/CPE ratio only = 2.2				
	ECiw (surface) = 2.6 ECiw (Bed) = 0.9 , IW/CPE ratio = NS				
	Interaction IW/CPE ratio = NS				

Net profit and B: C ratio:

The calculate the net profit (Rs/ha) and B: C ratio of pearl millet crop presented in table3. The table 3 clearly indicated that the maximum net profit was obtained in IW/CPE ratio (0.9) in bed sowing method Rs. 12,136 followed by flat sowing method Rs. 10,157. The salinity levels of irrigation water the highest net profit was taken in Baw Rs. 12,136 and lowest in ECiw 12 dS/m Rs. 10,478 in IW/CPE ratio (0.9) in BAW, respectively. The method of sowing the highest B: C ratio was obtained in bed sowing method IW/CPE ratio (0.9) in BAW irrigation treatment 1.67 compared with IW/CPE ratio (0.9) in flat method of sowing 1.26. In case of salinity levels of irrigation water the maximum B: C ration was recorded in 1.67 in BAW irrigated treatments and lowest in 1.38 in ECiw 12dS/m treatment IW/CPE ratio (0.3), respectively

Table 3- Net profit and B: C ratio of pearl millet crop in different treatments. (Av. Two years)

ECiw levels (d S/m)	IW/CPE ratio / method of sowing Flat 0.9	0.9	Bed 0.6	0.3
Pearl millet				
BAW	10157	12136	11784	11520
8	8971	11559	11236	11012
12	7944	10478	10102	10009
B : C ratio (pearl millet)				
BAW	1.26	1.67	1.62	1.59
8	1.12	1.59	1.55	1.52
12	0.99	1.44	1.39	1.38

Soil salinity:

The table 4 clearly indicated that the soil samples taken in at sowing time of pearl millet crop and harvesting time of the crop. The soil samples taken in three places of bed i.e. furrow middle (FM), bed side (BS) and bed middle (BM) in the depth of (0-15 and 15-30 cm). In the sowing time salinity was maximum in IW/CPE ratio (0.9) with ECiw 12 dS/m. In case of harvesting time this value was decrease cause of no application of saline water in irrigation.

Table 4- Soil ECe (d S/m) in pearl millet crop bed sowing method (Av. 2 years)

Treatments	Depth (cm)	**Sowing**			**Harvesting**		
IW/CPE-ratio		FM	BS	BM	FM	BS	BM
BAW	0-15	3.9	3.7	3.7	3.4	3.6	3.9
0.3	15-30	3.6	3.7	3.7	3.3	3.6	3.7
0.6	0-15	4.2	4.2	4.0	3.5	3.7	4.0
	15-30	4.2	3.9	3.9	3.5	3.7	3.7
0.9	0-15	4.4	4.3	4.2	3.6	3.7	4.2
	15-30	4.4	4.3	4.1	3.6	3.5	3.8
ECiw-8	0-15	5.6	5.6	5.5	4.6	4.9	5.0
0.3	15-30	5.5	5.4	5.3	4.4	4.7	4.9
0.6	0-15	6.2	6.2	6.1	4.7	4.9	5.2
	15-30	6.8	6.7	6.5	4.6	4.8	5.0
0.9	0-15	6.8	6.7	6.5	4.9	5.2	5.5
	15-30	7.1	7.1	7.0	4.7	4.8	4.9
ECiw-12	0-15	7.1	6.9	6.8	5.4	5.6	5.8
0.3	15-30	7.2	7.3	7.5	5.0	5.1	5.4
0.6	0-15	7.8	7.5	7.6	5.7	5.7	5.8
	15-30	8.5	8.1	5.2	5.2	5.3	5.2
0.9	0-15	8.5	8.4	8.3	5.8	5.9	5.8
	15-30	9.0	8.6	8.6	5.6	5.4	5.4

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