

Short Communication

Performance of Pearl millet Genotypes at Different Salinity Levels in Western Rajasthan

Neelam Kumar Chopra¹ and Nisha Chopra¹

Central Arid Zone Research Institute, Regional Research Station, Pali 306 401, India

Limited ground water resources, coupled with high salinity, are widespread in Marwar tract of Rajasthan (Dhir and Bhatia, 1975). In Pali district alone, 0.15 m ha of land is irrigated with highly saline sodic water, unsuitable for irrigation (Jain, 1979). The relative performance and salt tolerance of pearl millet cultivars grown with saline water was evaluated.

The experiment was conducted during *kharif* 1990 and 1991 at Pali Marwar in split plot design, with three replications on the soils medium to fine in texture, shallow to moderate deep and belonging to red desertic soil group of loam to clay loam texture (Bhaskar, 1986). The irrigation water having salinity levels of 8.0, 12.0 and 15.0 dS m⁻¹, along with best available well water (4.6 dS m⁻¹), were used in the main plot. Saline water was synthesized by adding requisite amounts of NaCl, MgCl₂, CaCl₂ and Na₂SO₄ in well water, keeping SAR constant at 20, Ca to Mg ratio of 1:1.6 and Cl to SO₄ ratio of 4:1 up to 8 dS m⁻¹ and 5:1 for 12 and 15 dS m⁻¹. Three rows of each genotype, MH 269, MH 324, MH 333, MP 187, MP 204, MP 312, MP 210, MP 219, MH 409, MH

342, MH 368 and MH 435, were sown in each main plot forming sub-plot, on 18th and 8th July in 1990 and 1991, respectively. Two and three irrigations of 6 cm each were given in 1990 and 1991, respectively. The soil samples were collected from 0-30 cm depth, before sowing and after harvest of crop, and saturation extract of soil samples were analyzed for soil appraisal adopting USDA methods (Richards, 1954). Using the yield data and salinity of irrigation water (EC_w), simple linear regression analysis of type Y of MEC was determined. Yield per unit increase in salinity beyond threshold was calculated following Maas and Hoffman (1977).

The magnitude of salt build up increased with increase in salinity of irrigation water. At the time of sowing of pearl millet crop, EC_e values of 8.4 and 10.8 dS m⁻¹ in 1990 and 1991 were observed with 15 dS m⁻¹ irrigation water, which were due to saline water irrigation in mustard. At harvest, the soil salinity was less due to leaching of soluble salts in intermittent rains received during the season. The magnitude of salt build-up was more in 1991 (EC_e 10.8 with 15.0 dS m⁻¹ irrigation water) due to poor leaching of salts in low rainfall year (300 mm) compared to high rainfall (800 mm)

¹ Indian Agricultural Research Institute, Regional Station, Karnal 132001, India.

Table 1. Effect of saline water irrigation on yield and yield attributes of pearl millet cultivars

Treatment (dS m ⁻¹)	Germination (%)	Plant height (cm)		Effective tillers/ plant		Length of spike (cm)		Seed yield (g) per 2.5 m row length	
		1990	1991	1990	1991	1990	1991	1990	1991
4.6	41.9	178.3	164.9	2.3	4.9	23.9	21.5	446.2	418.0
8.0	39.4	182.3	162.8	2.2	2.9	22.8	21.6	370.9	315.1
12.0	28.2	160.0	157.8	2.7	2.2	22.4	20.5	323.3	257.3
15.0	5.8	152.6	152.3	3.3	3.2	22.2	20.3	275.9	213.2
SEm ±	3.5	3.1	9.8	0.33	0.4	0.5	0.8	41.7	28.5
CD at 5%	8.7	10.6	NS	NS	1.1	NS	NS	100.5	69.9
Cultivars									
MH 269	26.5	142.5	158.8	2.4	4.2	18.7	17.2	309.4	318.5
MH 324	21.6	164.5	151.8	3.2	4.5	22.2	21.6	374.9	330.2
MH 333	33.6	167.2	156.6	3.0	5.2	27.0	21.4	440.2	431.9
MH 187	32.9	180.8	139.3	2.1	3.6	24.4	16.7	329.8	280.6
MH 204	39.5	182.0	147.1	2.2	2.6	24.1	18.1	336.9	303.5
MH 312	24.8	172.9	153.8	2.1	1.9	23.8	18.1	345.0	298.0
MH 210	11.5	174.5	178.4	1.5	2.3	22.6	24.5	270.5	350.9
MH 214	28.5	183.4	160.4	2.7	2.3	22.4	20.2	307.0	332.8
MH 409	31.5	160.9	165.4	2.9	3.3	21.6	23.8	422.5	268.6
MH 342	36.3	169.9	154.2	3.2	2.5	22.0	22.3	328.3	230.2
MH 368	34.5	159.6	134.4	2.7	3.2	23.4	18.4	384.2	206.9
MH 435	24.3	161.6	159.7	3.6	2.9	23.2	19.3	400.1	258.2
SEm±	3.3	8.95	10.1	0.5	0.7	1.3	1.4	55.7	42.2
CD at 5%	6.6	17.9	19.6	1.0	1.3	2.6	2.8	109.1	82.4

in 1990 (ECe 4.03 with 15 dS m⁻¹ irrigation water). Higher soil salinity at sowing stage significantly reduced per cent germination in all the pearl millet genotypes. The increase in salinity of irrigation water caused significant reduction in grain yield of all the cultivars. The grain yield, expressed as percentage of the control, was reduced by 38.1 and 48.9% in 1990 and 1991, respectively. However, effect of salinity on the yield components was of varied magnitude. Length of spike was not affected in both the years by salinity of irrigation water. However, effective tillers per plant were significantly less in 1991 at higher

salinity levels, whereas, there was no significant effect in 1990 (Table 1).

The cumulative effect of per cent germination, effective tillers per plant and length of spike resulted in the highest grain yield in MH 333. Cultivars MP 187, MH 342, MH 368 and MP 210 had 25.0, 25.4, 13.0 and 38.5% less yield in 1990, and 35.0, 46.7, 52.0 and 19.0% less yield in 1991 compared to MH 333. The cultivar MH 333 showed least yield reduction at 15 dS m⁻¹ over the control and had maximum mean salinity index (Table 2). From the linear regression equation for cultivar vs salt tolerance, it is evident that MH 333

Table 2. Effect of saline water irrigation on salt tolerance of pearl millet cultivars

Varieties	Reduction at 15 dS m ⁻¹ over control	Mean salinity index	Slope	ECW for 50% yield decline	R2	Regression equation
MH 269	48.2	61.5	0.045	12.72	-0.97	-20.15x+512.98
MH 324	61.0	59.4	0.050	11.89	-0.91	-24.30x+578.30
MH 333	29.2	82.3	0.025	22.85	-0.92	-11.91x+530.52
MH 187	31.7	69.8	0.032	17.02	-0.87	-12.5x+428.36
MH 204	49.9	71.7	0.049	12.91	-0.97	-20.0x+518.26
MH 312	51.9	61.5	0.048	12.31	-0.98	-22.56x+555.87
MH 210	51.2	60.6	0.051	11.79	-0.98	-22.34x+527.08
MH 219	39.1	66.7	0.057	11.94	-0.97	-24.63x+563.75
MH 409	30.0	78.8	0.038	17.97	-0.96	-13.26X+476.90
MH 342	48.0	56.5	0.038	13.65	-0.79	-15.67x+428.05
MH 368	39.4	69.8	0.038	14.93	-0.98	-14.81x+442.38
MH 435	45.6	69.1	0.040	14.47	-0.97	-17.26x+499.93

Slope - Rate of reduction in yield with per unit increase in salinity beyond threshold value.

had the lowest reduction per unit increase in salinity beyond threshold and had higher ECw values for 50% yield decline. Therefore, MH 333 is considered best among the cultivars tested, with lower regression slope and higher values of ECw for 50% yield decline and in line with the findings of Maas and Hoffman (1977).

References

- Bhaskar, K.S. 1986. Comparative performance of different wheat varieties under saline water irrigation in Marwar tract of Rajasthan. *Annals of Arid Zone* 25: 92-94.
- Dhir, R.P. and Bhatia, O.P. 1975. Use of saline water in agriculture: Descriptive system. *Annals of Arid Zone* 14: 206-211.
- Jain, B.L. 1979. A note on the quality of ground waters in arid tracts of Pali district of western Rajasthan. *Annals of Arid Zone* 18: 135-139.
- Maas, E.V. and Hoffman, G.J. 1977. Crop salt tolerance-current assessment. *ASCEJ Irrigation and Drainage Division* 103: 115-134.
- Richards, L.A. 1954. *Diagnosis and Improvement of Saline and Alkali Soils*. USDA Handbook 60, Washington DC, U.S.A.