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SHORT COMMUNICATION

Performance of bottle gourd to saline water with drip irrigation method

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In the uncommand area of IGNP arid zones of Rajasthan, the ground water availability varies in quality and quantity both with time and space. Most of the ground water is saline or sodic in nature with different magnitudes. Development of technology for efficient and safer utilization of poor quality water for crop production is one of the thrust areas of research, as share of water allocation to agriculture is anticipated to reduce. It can be achieved through drip irrigation. Drip irrigation applies water directly to rhizosphere, thus maintaining high moisture within root zone without excess irrigation. These facts permit use of saline water through drip without risk of injury to crops and high salt concentration buildup near the plants. Use of poor quality water through a properly managed drip system provides advantage of reduced salinity level in the root zone. However, the degree of permissible water salinity for use in drip system depends on water quality, soil properties and salinity tolerance of particular crop. Several researchers have reported that through drip irrigation higher crop yields can be obtained along with considerable saving in irrigation water. Drip irrigation offers most uniform application water by restricting the water loss to minimum extent resulting into saving of irrigation water up to 50-60% and yield increases by 15-20% (Bangor, 1998). Singh and Singh (1978) reported that drip method resulted in increased yields in case of long gourd, round gourd and water melon by 41-47 % when same level of saline water is used. There is meagre information on use of saline water in sandy soils of western Rajasthan under drip method of irrigation in vegetables. Considering these in view an investigation was under taken on sandy soils with poor quality irrigation water, to study the efficiency of drip irrigation on bottle gourd.

A field experiment was conducted on sandy soils of Agricultural Research Station, Bikaner in kharif 2003 to 2004 to assess the tolerance of bottle gourd to different levels of irrigation water salinity through drip and flood methods. Treatment comprised of three salinity levels of irrigation water (EC 0.25, 3.0 and 6.0 dSm^{-1}) under two methods of irrigation i.e. drip and flood. The soils of experimental field was sandy in texture, alkaline in reaction (pH 8.4), low in organic carbon (0.10%) and medium in available phosphorous (24 Kg P_2O_5 /ha) and potash (200 Kg K_2O /ha). The experiment was laid out in randomized block design with three replications in plot size of 3m X 3m. The drip lateral was installed in the centre of each plot with on line drippers (PC types) of 4.0 lph discharge. The healthy hybrid seeds of bottle gourd (var. Gutaka) were sown by dibbling method with plant to plant spacing 1.0 metre in the last week of June during both the years of experimentation. The standard recommended agronomic practices were followed. Recommended dose of fertilizer (120 kg Nitrogen, 80 kg P_2O_5 and 60 kg K_2O) and plant protection measures were under taken. Sintex tanks of 1000 litres capacity each were used to supply water of required salinity. The water available from the tube well was used as basic source of saline water having EC 4.1 dSm^{-1}. The required salinity was achieved by adding the pre calculated amount of salts. Final picking of fruits were done up to first week of December. The treatments were evaluated in terms of yield attributing parameters, yield and water use efficiency. For analysis of salinity build up in soil profile due to saline water irrigation under drip and flood methods, soil samples were also taken at three points which were located horizontally at 0, 15 and 30 cm apart from the either side of emitter. At each of these three locations soil samples were collected from four depths i.e. 0-15. 15-30, 30-45 and 45-60 cm. Similarly, in case of flood irrigation soil samples were taken from the same four depths but at only one location. Soil samples were collected at sowing and harvesting of crop and analyzed as per method outlined by Richards (1954). Rainfall received during the crop season was 230 and 102.8 mm during 2003 and 2004.

Yield of bottle gourd differ significantly with EC_{iw} levels. Maximum yield was recorded with EC_{iw} 3.0 dSm^{-1} and it was at par as compared to best available IGNP canal water having EC 0.25 dSm^{-1}. Yield decreased significantly at EC_{iw} 6.0 dSm^{-1} in both the years. Maximum number of fruits per plant (8.3) and highest fruit weights (841g) were recorded in treatment EC_{iw} 3.0 dSm^{-1} (Table 1). About 23.75 % reduction in yield of bottle gourd was observed with water having EC_{iw} 6.0 dSm^{-1} as compared to EC_{iw} 3.0 dSm^{-1}. Singh *et. al., (2004)* also reported 40% reduction in yield of tomato at EC 8.0 dSm^{-1} in *rabi* season.

Maximum water use was observed in flood method of irrigation which was 32.35 % higher than drip method of irrigation. Whereas, highest mean water use efficiency of 443 kg / ha-cm was observed in treatment having ECiw 3.0 dSm^{-1} under drip method of irrigation (Table 2). Singh *et al,*. (1978) also reported higher yields compared to surface method when same level of saline water is used. Kadam and Kartikeyan (2004) also advocated superiority of drip method over surface method.

The resulting ECe at harvest as affected by salinity levels of irrigation water in 0-45 cm soil profile at 0, 15 and 30 cm lateral distances from the emitter are shown

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in Table 3. In general, the soil salinity increased with increase in salinity of irrigation water at all depths and locations. Zone of minimum salt concentration existed below the emitter in studied soil profile. The trend clearly indicate that the salt concentration in soil profile increase with increase in lateral as well as vertical distance from the emitters. This is due to differences in moisture content of ponded, wetted and wetting zone of area irrigated by a particular emitter. The ponded zone have always higher moisture both laterally and vertically which starts decreasing as we move toward wetted zone with minimum at the end of wetting zone. This moisture variation causes movements of salts from the near vicinity of emitter, creating comparatively much less saline zone in which root perform there activity. In other words it can be inferred that the salts are leached away from the active root zone of plant providing better growing conditions. Salt concentration was highest at 30 cm distance from emitter. This may be due to fact that salts have moved with water away from active root zone.

Bottle gourd can be grown successfully with moderate saline water up to 3.0 dSm^{-1} on sandy soils of western Rajasthan with drip irrigation method.

Table 1. Effect of different salinity levels of water and method of irrigation on yield and yield attributes of bottle gourd

Treatments	Yield (q ha^{-1})			No of fruit/plant			Av. Fruit weight (g)		
	2003	2004	Mean	2003	2004	Mean	2003	2004	Mean
Drip method ECiw (dSm^{-1})									
0.25	185	218	207	6.5	7.5	7.0	740	801	771
3.0	234	247	240	7.9	8.7	8.3	806	875	841
6.0	164	197	183	4.6	4.8	4.7	527	563	545
Average	194	221	210	6.3	7.0	6.7	697	746	719
Flood method ECiw (dSm^{-1})									
0.25	181	198	190	6.9	7.1	7.0	675	730	703
3.0	172	183	178	6.5	6.9	6.7	622	660	641
6.0	147	163	155	3.1	3.7	3.4	492	528	510
Average	167	181	174	5.5	5.9	5.7	596	639	618
LSD (p= 0.05%)									
EC	9.3	1.3	4.6	0.2	0.2	0.2	15.7	14.6	13.0
M	6.2	0.8	3.1	0.1	0.1	0.1	10.5	9.7	8.7
ECX M	18.7	2.5	9.2	0.4	0.4	0.4	31.3	29.1	26.0

Table 2. Water Use (mm) and WUE (Kg/ ha /cm) through drip and flood method

Treatments	Water Use (mm)			WUE (Kg/ ha-cm)		
	2003	2004	Mean	2003	2004	Mean
Drip method ECiw (dSm^{-1})						
0.25	518	547	533	357	398	378
3.0	523	562	542	447	439	443
6.0	556	574	565	264	284	274
Average	532	561	547	356	374	365
Flood method ECiw (dSm^{-1})						
0.25	703	734	720	257	270	264
3.0	712	746	729	242	245	244
6.0	737	712	725	199	229	214
Average	717	731	724	233	248	241

Table 3. Salinity (ECe) build up in soil profile with saline water irrigation through drip irrigation after bottle gourd

Soil depth (cm)	Drip			Flood		
	0.25	3.0	6.0	0.25	3.0	6.0
	Just Below emitter					
0-15	0.40	1.33	1.96	0.62	1.21	1.63
15-30	0.48	1.07	1.83	0.58	1.59	2.17
30-45	0.56	1.53	2.24	0.55	1.66	2.55
45-60	0.52	1.74	2.21	0.51	1.80	2.90
	15 cm distance from emitter					
0-15	0.56	1.79	2.2	0.62		
15-30	0.48	1.98	2.14	0.58		
30-45	0.42	1.97	2.48	0.55		
45-60	0.56	2.1	2.73	0.51		
	30 cm distance from emitter					
0-15	0.7	2.01	2.61	0.62		
15-30	0.62	2.39	2.92	0.58		
30-45	0.78	2.13	3.1	0.55		
45-60	0.85	2.47	3.75	0.51		

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