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Evaluation of drip irrigation and mulches on the yield and yield attributes of bottle gourd [*Lagenaria siceraria* (Molina) Stendl.]

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Abstract

Water is one of the precious input on which productivity of vegetable crops depends. However the precious input is scarcity available in hot arid areas of Rajasthan. Besides rain water, both surface and ground water being used for vegetable production. The water is applied to the plants either through gravity flow system or pressurized irrigation system. It is estimated that the efficiency of canal irrigation system is about 40% resulting in wastage of water with low application efficiency. Therefore, a field experiment on the use of drip irrigation system with and without mulches was conducted during the year 2006 & 07 in the rainy season at research farm of COA, SKRAU, Bikaner. There were four volume of water and three mulches were used singly and in their possible combination. The maximum length of fruit and number of fruits were observed with the treatment of drip 0.70 V and among the mulches these parameters were higher under organic mulch. The maximum fruit yield was recorded with application of 0.70 V of water and with organic mulch singly and in combined form.

Key words: Drip irrigation, bottle gourd, mulching

Introduction

Rajasthan, though the largest state in the country the area under vegetables in the state is 135682 ha with production of 818900 M tones (Annony.2009). The productivity in the state is 6.0 tones/ha which is very less than the national productivity of 16.1 tones/ha. It is attributed to poor cultural management practices including irrigation management, especially in arid region, where leaching losses of water is very high. Therefore, the root suffers for water deficit and the potential of crop is not expressed in true-to-type. Micro irrigation has got rid-off such problem and it is benefiting option as far as water use economy is concerned.

Water is the most valued agri-input required for successful growth of the plants. Being chief constituent of protoplast, universal solvent and carrier of solutes in plant metabolic system, water is most inevitable input governing the cultivation of any crop. In vegetable crops which are largely herbaceous in nature, water management deserves special significance especially in bottle gourd crop which requires wide spacing. Furthermore, in arid region where water has been scarce input for the production of vegetables for long period, any technique offering water to the plant in efficient manner is a matter of worth consideration. Drip irrigation system, letting in water drop by drop to the plant, has been proved efficacious in harvesting better crop yield at the cost of per unit consumption of water. In arid regions due to high thermal stress, wind velocity, low and erratic rainfall, moisture losses through evaporation and transpiration is more and affect the much productivity of the vegetables. It has been observed that temperature in the plant root zone during peek summer season (40-45 DC) leading to rapid drying of soil which seriously affect the growth and establishment of the plant. Walkar(1969)reported that even at 1 DC difference in soil temperature could have a significance role on plant growth. The technique of mulching both organic and inorganic is effective in minimizing the water loss from soil surface as a result of solar radiation and wind action. Therefore, the present investigation was carried out to find out the optimum water requirement under drip system in bottle gourd under arid conditions.

Material and methods

The field experiment was conducted during *kharif* season of 2006 and 2007 at College of Agriculture, Bikaner. The experimental site lies in hyper arid partially irrigated western plain (zone IC) of Rajasthan that comes under M2 agro climatic zone (major Region) and M9EI (sub region). as per NBSS and LUP. The average annual rainfall is varies from 141 mm to 325 mm. The mean daily maximum goes up to 42°C during summer with relative humidity less than 4 per cent and 23.6°C during winter. The soil having pH 8.4 with percolation rate 9 cm/hour (Singh, 2002).

Further experiment, was undertaken on Hybrid "Ward" which is one of the popular hybrid of bottle gourd. The drip irrigation system consisted of 75 mm and 63 mm main and sub main line, respectively, with lateral (16 mm) spacing 160 cm and dripper (3 lph) spacing 75 cm. There were five treatments of irrigation consisting four levels of irrigation viz. 1.0. 0.85. 0.70, and 0.55 volume applied through drip and 1.0 volume of irrigation through surface (flood irrigation) method. The three sub treatments of with and without mulch of 25 micron LLDPE black polythene film (mulch) and organic mulch "*Kheep*" (Dry Kheep was used @ 0.5 kg /running meter).The experiment was laid out in split plot design and was replicated four times.

The daily irrigation was applied as per plant requirement and calculated on the basis of class 'A' pan evaporation data. The volume of water required was calculated by multiplying the pan evaporation with the crop coefficient at different crop stages, pan coefficient, the plant to plant spacing, the row to row spacing and per cent wetted area (Rana et al., 2004). The calculated water on the basis of pan evaporation was applied as per treatment. In surface irrigation, measured quantity of water required by plant per day was applied.

Results and discussion

The length of fruit was significantly influenced by application of different volume of water in both years (2006 and 2007). The maximum length of fruit was recorded under the treatment drip 0.70 volume which was significantly higher than rest of the treatment. The higher number of fruits per plant was recorded with drip 0.70 water volume treatment ie. 10.63 and 10.12 while the lowest i.e. 8.74 and 8.67 with the surface irrigation treatment in both the years of observation (2006 and 2007), respectively. The application of water volume 0.70 significantly influenced the average weight of fruit (448 and 443 g) and yield of fruit (401.6 and 391.2 q) than the surface irrigation in 2006 and 2007, respectively. To achieve the maximum yield under 0.70 water volume, the average water quantity 2.26 and 2.14 liter /day/plant was applied, however, it was applied 3.23 and 3.06 liter in surface irrigation treatment in 2006 and 2007, respectively. The probable reason is that the water volume 0.70 seems to be optimum water quantity which is required by plant, however more water volume increase the vegetative growth of plant which inhibited the exposure of sunlight, which is essential for flowering and fruiting (Singh and Gangwan, 1972). Different mulches viz. no mulch, polythene mulch and organic mulch showed significantly variation on yield and yield attributing characters in the study. It is evidence from the table -1 that the soil temperature was influenced by the different mulches and it was minimum (30.02, 29.92 °C) under organic mulch than no mulch (35.02,35.27 °C) however, it was maximum under polythene mulch (40.29 , 40.56 °C) in both years (2006 and 2007), respectively. Similarly, average number of fruit per plant and average weight of fruit were increased under organic mulch; however, black polythene mulch could not influence both the parameters. The highest fruit yield (406.8 and 395.6 q/h) was obtained with organic mulch whereas no mulch recorded only 365.6 and 358.4 q/ha. in 2006 and 2007, respectively. Because, the organic mulch developed of suitable soil moisture regime favorable for efficient nutrient uptake and also increase microbial population resulting in better biological growth and higher harvest (Mangal, 1990 and yadav,2007). The organic mulch maintains the both temperature and moisture in soil which is essential for better root development and other physiological activities of the plant. On the other side, a great reduction was observed in yield under black polythene mulch in comparison to control. It may be attributed to increase in temperature beyond the optimum limit under black polythene which inhibits the physiological activity of plant

It is evident from the study that the significantly higher No. of fruit (11.85 and 10.75) and maximum yield (493.4 and 476.0 q/h) were recorded with application of 0.70 volume of water with organic mulch in both years 2006 and 2007, respectively.

Treatments	Soil temperature at 40°C (upto 30 cm depth)		Length of fruit (cm)		Average No. of fruits per plant		Average weight of fruit (gm)		Yield (q/ha)		Average water applied (Lt/day/plant)	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Surface irrigation	35.67	35.77	31.79	31.45	8.74	8.67	378	373	274.9	271.2	3.23	3.06
Drip 1.0 water volume	34.56	34.62	33.81	32.65	9.79	9.43	399	391	325.7	325.6	3.23	3.06
Drip 0.85 water volume	34.92	35.12	34.69	33.65	10.03	9.78	432	408	363.9	354.4	2.74	2.60
Drip 0.70 water volume	35.18	35.27	36.41	33.68	10.63	10.12	448	433	401.6	391.2	2.26	2.14
Drip 0.55 water volume	35.23	35.42	34.55	33.42	10.45	9.80	443	405	382.0	371.5	1.78	1.68
S. Em.±	0.31	0.28	0.37	0.39	0.08	0.056	3.18	3.68	2.63	10.55	-	-
CD at 5%	NS	NS	1.14	1.29	0.25	0.173	9.80	11.36	8.11	32.51	-	-
No mulch	35.02	35.27	36.18	35.46	9.93	9.54	439	413	365.6	358.4	2.65	2.51
Polythene mulch	40.29	40.56	28.64	28.26	9.21	9.21	361	358	276.5	273.2	2.65	2.51
Organic mulch	30.02	29.92	37.94	36.39	10.65	9.94	454	435	406.8	395.6	2.65	2.51
S.Em.±	0.75	0.82	0.21	0.28	0.04	0.038	2.20	2.30	2.06	6.40	-	-
CD at 5 %	2.50	2.67	0.61	0.85	0.13	0.11	6.35	6.65	5.97	18.51	-	-

Table 2. Interaction effect of water volume and mulches on the yield bottle gourd (year 2007)

Treatments	Yield (q/ha)						Number of fruit per plant					
	Without mulch		Polythene mulch		Organic mulch		Without mulch		Polythene mulch		Organic mulch	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Surface irrigation	284.0	280.7	246.1	240.5	294.8	292.7	8.85	8.78	8.43	8.38	8.95	8.85
Drip 1.0 water volume	334.8	328.5	277.9	295.0	364.4	351.5	9.75	9.25	4.26	9.21	10.36	9.85
Drip 0.85 water volume	396.5	385.2	281.3	271.0	414.1	406.5	10.31	9.75	9.32	9.45	11.46	10.14
Drip 0.70 water volume	420.7	414.2	290.6	284.2	493.4	476.0	10.51	9.12	9.54	9.51	11.85	10.75
Drip 0.55 water volume	392	385.2	286.5	277.5	467.4	452.5	10.22	9.79	9.48	280.7	11.65	10.10
S.Em. ±	4.62	14.33	-	-	-	-	0.1006	0.0856	-	-	-	-
CD at 5%	13.35	41.39	-	-	-	-	0.2906	0.2474	-	-	-	-

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