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Effect of drip irrigation levels and fertigation on capsicum cultivars under protected cultivation

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Abstract

An experiment was conducted during 2010-11 and 2011-12 in poly-house at Niche Area Excellence Farm, Bikaner to study the effect of drip irrigation and fertigation levels on plant height, fruit yield, and water use efficiency of capsicum. The treatments consists of three drip irrigation schedules viz. 40, 60 and 80% ETc and three fertigation levels viz. 75%, 100% and 125% of recommended dose of fertilizers. The experiment was conducted in randomized block design and replicated thrice. The study indicated that there was increase in plant height, fruits /plant and fruit yield with increase in irrigation levels from 40% to 80% ETc. but the water use efficiency decreases with increasing irrigation levels. The study further indicated that plant height, fruits /plant, fruit yield and water use efficiency also increased with increasing the fertigation levels from 75% to 125% recommended dose of fertilizer.

Key words: Fertigation, drip irrigation level, capsicum, water use efficiency.

Introduction

Rajasthan, particularly western region comes under hyper arid zone with very scarce water resource, scanty and erratic rainfall. The arid climate is quite extreme with temperature as high as near about 49^0C in summer and as low as 0^0 C in winter . Thus, adoption of protected cultivation may prove useful for improving farm income and it is an effective tool for higher and quality production. Capsicum grown in the naturally ventilated polyhouse showed four times more yield and yield component compared to those grown in the field (Nagalakakshmi et al., 2001). Drip irrigation maintains moisture content at near about field capacity in one hand and eliminates water losses on other hand. Fertigation with drip irrigation also enhance the water use efficiency as compare to sole application of fertilizers. Drip irrigation along in conjunction of fertigation increase fruit yield of capsicum by about 40% over control inside the polyhouse (Singh et al., 2010). Overall growth in terms of height of plant numbers of leaves per plant inside the green house was more compared to open field (Ghosal and Das, 2012). Capsicum is a long duration crop but early flowering and fruiting observed in greenhouse condition (Ghosal and Das, 2012). Production of vegetables under protected cultivation system results in effective use of the land resources, beside being able to increase the production of quality vegetables for both the export and domestic markets by offsetting biotic and abiotic stresses to a great extent that otherwise prevalent in open. Cultivation of capsicum in a polyhouse was found to be highly feasible as reflected in higher values of net present value (NPV), B:C ratio and internal rate of return with payback period of less than two years (Murthy et al., 2009).

Materials and methods

An experiment was conducted during 2010-11 and 2011-12 in poly-house at Niche area excellence farm, S K Rajasthan Agricultural University, Bikaner situated in arid western hyper arid zone of Rajasthan. The soil was sandy loam in nature, having field capacity 6.6%, PWP 1.9%, bulk density 1.52 g /cc, pH (1:2) 8.3, electrical conductivity (1:2) 0.15 dS/m. The soil is very low in organic matter (0.10%) and medium in available P (33 kg/ ha) and high in available K (350 kg/ ha). The experiment was laid out in randomized block design with three replications. The treatments consist of three irrigation levels (40%, 60% and 80% ETc) and three fertigation levels (75%, 100% and 125%). The total irrigation water provided was 489.62, 655.54 and 979.26 mm at 40%, 60% and 80% ETc, respectively (Table 1). Ground water was below 10 m throughout the growth period. Capsicum variety Indra was sown at 30 cm plant to plant and 60 cm row to row spacing on October 15, and capsicum fruits were harvested 13 times from December 10 to July 15-18 under protected cultivation in both the years. Under ambient condition fruits were harvested 5 times at 15 days interval during December 10 to February 20, in both the years. All the cultural operations were carried out as per recommendations.

Results and discussions

Irrigation levels

Increasing irrigation levels from 40% to 80% ETc under drip system increased plant height, fruit/ plant and fruit yield (Table 2). Increased plant height and yield attributes with increasing irrigation levels through drip irrigation thus, enhanced fruit yield of capsicum and highest fruit yield of 814 q /ha was recorded at 80% ETc against 655 and 251 q /ha with irrigation at 60%, 40% ETc through drip and surface irrigation, respectively. The above observation revealed that all drip irrigation levels under protected cultivation gave significantly higher fruit yield of capsicum than surface irrigation at open field condition (251 q/ha). This is in confirmatory with Nagalakshami et al., 2001, who reported that capsicum grown in naturally ventilated poly house showed four times more yield and yield component compared to those grown in the field.

Capsicum being a long duration crop under protected cultivation used more water than the crop grown in open field condition. Highest amount of water use (979.26 mm) was recorded with 80% ETc followed by 655.54 and 575.25 mm with 60% ETc under protected cultivation and surface irrigation under open field condition, respectively. Increased water use in protected cultivation decreased water use efficiency. Thus, crop grown with 40% ETc in polyhouse gave the highest water use efficiency (133.77 kg/ ha-mm) against 112.88 and 83.12 kg/ ha-mm with 60 and 80% ETc, respectively under protected cultivation. Lowest water use efficiency of 43.45 kg/ha-mm was recorded with surface irrigation under open field condition. Lower water use efficiency in surface irrigation (absolute control) may be due to loss of irrigation water from sandy loam soil through deep percolation resulted in higher water use and low fruit yield as the crop was exposed to natural adverse climate.

Fertigation

The study of three fertigation levels indicated that plant height, fruit per plant, fruit yield and water use efficiency increased with increasing the fertigation level from 75% to125% recommended dose of fertilizer. However fruit per plant were not significantly influenced by higher dose of fertilizers and it was statistically at par with 100% and 125% recommended dose of fertilizer. The highest fruit yield 797 q/ha was recorded at 125% recommended dose against 740 and 672 q/ha at 100% and 75% recommended dose, respectively (Table 2).

The water use in 75% to 125% recommended dose of fertilizers was same but the water use efficiency increased with increasing the fertigation level from 75% to 125% of recommended dose of fertilizer. The highest water use efficiency of 112.54 kg/ha-mm was recorded at 125% of recommended dose as against 104.45 and 94.90 kg/ha-mm at 100% and 75% of recommended dose of fertilizer, respectively.

Table 1 : Month-wise irrigation events and irrigation water applied (mm) under polyhouse (mean of two years)

Month	Irrigation events	Drip irrigation (mm)		
		40% ETc	60% ETc	80% ETc
October (15-31)	8	19.09	25.39	38.18
November	15	40.79	54.25	81.59
December	15	36.57	49.01	73.15
January	16	36.58	49.02	73.17
February	14	27.14	36.36	54.27
March	15	57.68	77.29	115.36
April	16	78.00	104.52	156.00
May	15	103.63	138.87	207.27
June	16	81.74	109.53	163.47
July (1-7)	3	8.40	11.30	16.80
Total	133	489.62	655.54	979.26

Table 2: Effect of drip irrigation and fertigation on height, yield attributes and yield of capsicum under protected cultivation (pooled of two years)

Treatment	Plant height at harvest (m)	Fruit/ plant	Fruit yield (q/ha)	Water use (mm)	Water use efficiency (kg/ha-mm)
Irrigation level					
40% ETc	3.09	12.1	655	489.62	133.77
60% ETc	3.75	15.8	740	655.54	112.88

80% ETc	3.88	15.9	814	979.26	83.12
Control (Surface irrigation)	1.32	7.4	251	575.25	43.45
SEm±	0.06	0.3	5		
CD at 5%	0.18	0.9	14		
Fertigation					
75% RD	3.05	13.7	672	708.14	94.90
100% RD	3.69	14.8	740	708.14	104.45
125% RD	3.98	15.3	797	708.14	112.54
SEm±	0.06	0.3	5	-	-
CD at 5%	0.18	0.9	14	-	-

References

Ghosal, M. K. and Das, R. K. 2012. A study on the cultivation of capsicum in a greenhouse during offseason in warm and humid climate of India. *International Journal of Agricultural Sciences*, 8(1):220-223.

Murthy, D. S.; Prabhakar, B.S.; Hebbar, S.S.; Srinivas,V. and Prabhakar. M. 2009. Economic feasibility of vegetable production under polyhouse: a case study of capsicum and tomato. *Journal of Horticulture Science*, 4(2):148-152.

Nagalakshmi, S; Aandakumar, N.; Palanisamy, D. and Sreenarayanan,V. 2001.Naturally ventilated polyhouse for vegetable production. *South Indian Horticulture*, 49(Special):345-346.

Singh, K.G; Angrej Singh and Gulshan Mahajan. 2010.Response of sweet pepper (Capsicum annum) to irrigation and fertigation grown in naturally ventilated polyhouse. *Indian Journal of Agricultural Sciences*, 80(5):430-432.