

Yield response of cucumber (*Cucumis sativus* L.) to different fertigation levels

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Received : 23.07.2016; Revised : 19.08.2016; Accepted : 05.09.2016

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■ **ABSTRACT** : A field experiment was conducted at the Instructional Farm of Department of Irrigation and Drainage Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, to study effect of different fertigation levels on cucumber (var. Gypsy) production under shade net house with 35, 50 and 75 per cent shading with open field trial. Amongst growth attributes, days to 50 per cent flowering, average diameter of the fruit, average length of fruit, average weight of fruit, length of vine were recorded and were significantly influenced by fertigation. Application of 125 per cent NPK through drip irrigation recorded maximum yield of 21.87 t ha⁻¹ also showed maximum net income followed by application of 125 per cent N through drip irrigation and soil application P and K as basal dose of a 21.61 t ha⁻¹. The maximum FUE was observed with 100 per cent NPK through drip irrigation system (68.73 kg/kg).

■ **KEY WORDS** : Fertigation, Cucumber, Biometric parameters

■ **HOW TO CITE THIS PAPER** : Patil, Mangal and Gadge, S. B. (2016). Yield response of cucumber (*Cucumis sativus* L.) to different fertigation levels. *Internat. J. Agric. Engg.*, 9(2) : 145-149, DOI: 10.15740/HAS/IJAE/9.2/145-149.

Drip irrigation is a highly efficient method of water application, which is ideally suited for controlling the placement and supply rate of water – soluble fertilizers. Nutrient can be injected at various frequencies (daily to monthly), depending on system design constraints, soil type and grower preference. Cucumber is most important vegetable mostly grown worldwide under protected cultivation for fresh consumption and processing. Cucumbers (*Cucumis sativus* L.) are high yielding but frost-sensitive vegetables. They give satisfactory yield as an early-season crop and well during the summer but taken throughout the year. Increase in cucumber production can be achieved either bringing more area under its cultivation, or by adopting improved varieties and better cultural practices. The second approach is more often preferred and among various cultural practices fertilizer application is one of the

quickest and easiest ways of increasing the yield per unit area under cucumber.

The results obtained in the past investigation indicated that application of N, P₂O₅, K₂O by fertigation found to be optimum for better growth, for better yield and for better utilization of fertilizers (Madane, 1999) and maximum vine length, fruit diameter, fruit weight, number of fruits/vine, yield/vine and yield/ ha and maximum nutrient content in the crop and minimum nutrient residues in the soil after harvest were recorded when recommended dose of fertilizers was applied (Choudhari and More, 2002). Likewise, fertigation indicates saving of 30 per cent N while P and K of 20 per cent and saving per cent of water use was nearly 51 per cent (Tumbare and Bhoite, 2002) and is more effective than the conventional method (soil application) for improving the greenhouse crop yields (Al-Wabel *et*

al., 2006). The application of fertilizers through drip system is observed to be more effective than the conventional methods. Better uptake of fertilizer was observed with frequent application of fertilizers in appropriate doses at proper growth stages. It also shows higher benefit – cost ratio (Janpriya *et al.*, 2010). Thus, the investigation was done to study the yield response of cucumber grown under shade net house with different fertigation levels.

■ METHODOLOGY

Experimental details :

Field experiment was conducted during the summer of 2012 from January to May at Department of Irrigation and Drainage Engineering, MPKV, Rahuri to study the yield response of cucumber (var. Gypsy) to different levels of fertigation. The size of the each shade net and the open field was 18 m x 16 m. The experiment was laid out in split plot design with four main treatments, six sub-treatments and four replications. The size of each plot was 2 m x 3.9 m. A 0.5 m buffer strip was provided between two beds to avoid lateral movement of water from one bed to another.

Treatment details :

There were six treatments of fertigation given to cucumber grown under shade net compared with open field treatment. The treatments were as follows:

Main treatments (shading percentage) :

- S₁: – 35 per cent shading
- S₂: – 50 per cent shading
- S₃: – 75 per cent shading
- S₄: – 0 per cent shading *i.e.* full sunlight.

Sub – main treatments (fertigation levels) :

- T₁ = Soil application of recommended dose of NPK (control),
- T₂ = Application of 100 per cent N through drip and soil application of P and K,
- T₃ = Application of 125 per cent N through drip and soil application of P and K,
- T₄ = Application of 100 per cent NPK through drip,
- T₅ = Application of 125 per cent NPK through drip,
- T₆ = Application of NPK ratio as per the crop growth stages with 125 per cent N.

Fertigation :

Gator pump was used for injecting the fertilizers into the drip irrigation system.

Treatment T₁ (100 % N, P and K soil application)

In treatment T₁, NPK @ 50:50:50 was given as basal dose and remaining dose of 50:00:00 was given in two different splits (Table A).

Treatment T₂ (100 % N through drip + soil application of 100 % P and K)

In treatment T₂, NPK @ 00:50:50 was given as a basal dose and dose of 100:00:00 was given through drip in 27 splits (Table B).

Dose	No. of splits	Quantity of fertilizer (kg/ha)		
		18:18:10	MOP (00:00:58)	Urea
Basal dose (50:50:50)	1	278	37	--
50:00:00 (30 days interval)	2	--	--	54

Dose	No. of splits	Quantity of fertilizer (kg/ha)		
		SSP (00:16:00)	MOP (00:00:58)	Urea
Basal dose (00:50:50)	1	313	86.21	--
100:00:00 (30 days interval)	26	--	--	218

Dose	No. of splits	Quantity of fertilizer (kg/ha)		
		SSP (00:16:00)	MOP (00:00:58)	Urea
Basal dose (00:62.5:62.5)	1	391.25	108	--
125:00:00 (3 days interval)	26	--	--	272

Table D : Fertilizer application for treatment T₄			
Dose	No. of splits	Quantity of fertilizer (kg/ha)	
		19:19:19	Urea
100:00:00 (3 days interval)	26	265 (10.31 kg/ha/split)	108 (4.20 kg/ha/split)

Table E : Fertilizer application for treatment T₅			
Dose	No. of splits	Quantity of fertilizer (kg/ha)	
		19:19:19	Urea (46:00:00)
125:62.5:62.5 (3 days interval)	26	331.25 (12.88 kg/ha/split)	135 (5.25 kg/ha/split)

Table F : Fertilizer application for treatment T₆				
Dose	No. of splits	Quantity of fertilizer (kg/ha)		
		19:19:19	Urea (46:00:00)	13:00:45
Stage 1 (37:14:14) (3 days interval)	8	75 (9.38 kg/ha/split)	50 (6.25 kg/ha/split)	--
Stage 2 (25:19:28) (3 days interval)	4	100 (25 kg/ha/split)	8 (2 kg/ha/split)	20 (5 kg/ha/split)
Stage 3 (63:14:99) (3 days interval)	14	75 (5.36 kg/ha/split)	52 (3.71 kg/ha/split)	188 (13.43 kg/ha/split)

Treatment T₃ (125 % N through drip + soil application of 125 % P and K)

In treatment T₃, NPK @ 00:62.50:62.50 was given as a basal dose and dose of 125:00:00 was given through drip in total 27 splits (Table C).

Treatment T₄ (100 % NPK through drip)

In treatment T₄, NPK @ 100:50:50 were given through drip irrigation system in total 26 splits (Table D).

Treatment T₅ (125 % NPK through drip)

In treatment T₅, NPK @ 125:62.5:62.50 were given through drip irrigation in total 26 splits (Table E).

Treatment T₆ (125 % N+ PK through drip stage wise)

In treatment T₆, NPK @ 125:47:141 grades were given through drip in 26 splits (Table F).

Fertilizer use efficiency :

Fertilizer use efficiency was calculated by using the formula :

$$\text{Fertilizer use efficiency} = \frac{\text{Yield (kg/ha)}}{\text{Quantity of fertilizer applied (kg/ha)}} \dots(1)$$

Table 1 : Effect of fertilizer levels on cucumber yield and performance							
Treatments	Days to 50 % flowering	Average diameter of fruit	Average length of fruit	Average fruit weight	Length of vine at last harvest	No. of fruits per vine	Yield of fruit per vine (t/ha)
T ₁	34.63 ^a	3.70 ^b	14.44	141.18 ^a	3.27	5.95 ^a	17.48 ^a
T ₂	35.61 ^a	3.89 ^b	14.31	141.73 ^a	3.23	6.75 ^a	20.00 ^a
T ₃	33.63 ^b	3.78 ^b	14.71	148.39 ^b	3.21	6.94 ^b	21.61 ^b
T ₄	33.75 ^b	3.58 ^a	14.62	150.69 ^b	2.79	5.99 ^a	19.02 ^a
T ₅	35.56 ^a	3.27 ^a	14.39	149.27 ^b	3.17	6.94 ^b	21.87 ^b
T ₆	35.44 ^a	3.54 ^a	14.28	147.97 ^b	2.89	6.08 ^a	19.01 ^a
S.E. ±	0.33	0.13	0.32	1.18	0.13	0.30	0.30
C.D. (P=0.05)	0.95	0.37	NS	3.33	NS	0.84	0.84

Note: Higher superscript denotes best treatment

NS= Non-significant

Biometric observations :

Observations of days to 50 per cent flowering, average length of fruit, average diameter of fruit, average weight of fruit, length of vine at last harvest, number of fruits per vine, yield of fruit were recorded and the data were analysed statistically.

■ RESULTS AND DISCUSSION

The EC and pH of the media in shade net house were 0.63 and 6.22, respectively and that for soil in open field were 0.68 and 6.71, respectively. The available N, P and K for media in shade net house was 202.79, 38.87 and 201.60 kg ha⁻¹, respectively and that of for soil in open field was 144.25, 57.24 and 392.00 kg/ha⁻¹, respectively.

Biometric observations :

The biometric observations recorded for cucumber crop grown under different treatments were statistically analysed and the results are presented in Table 1 and graphically presented in Fig. 1.

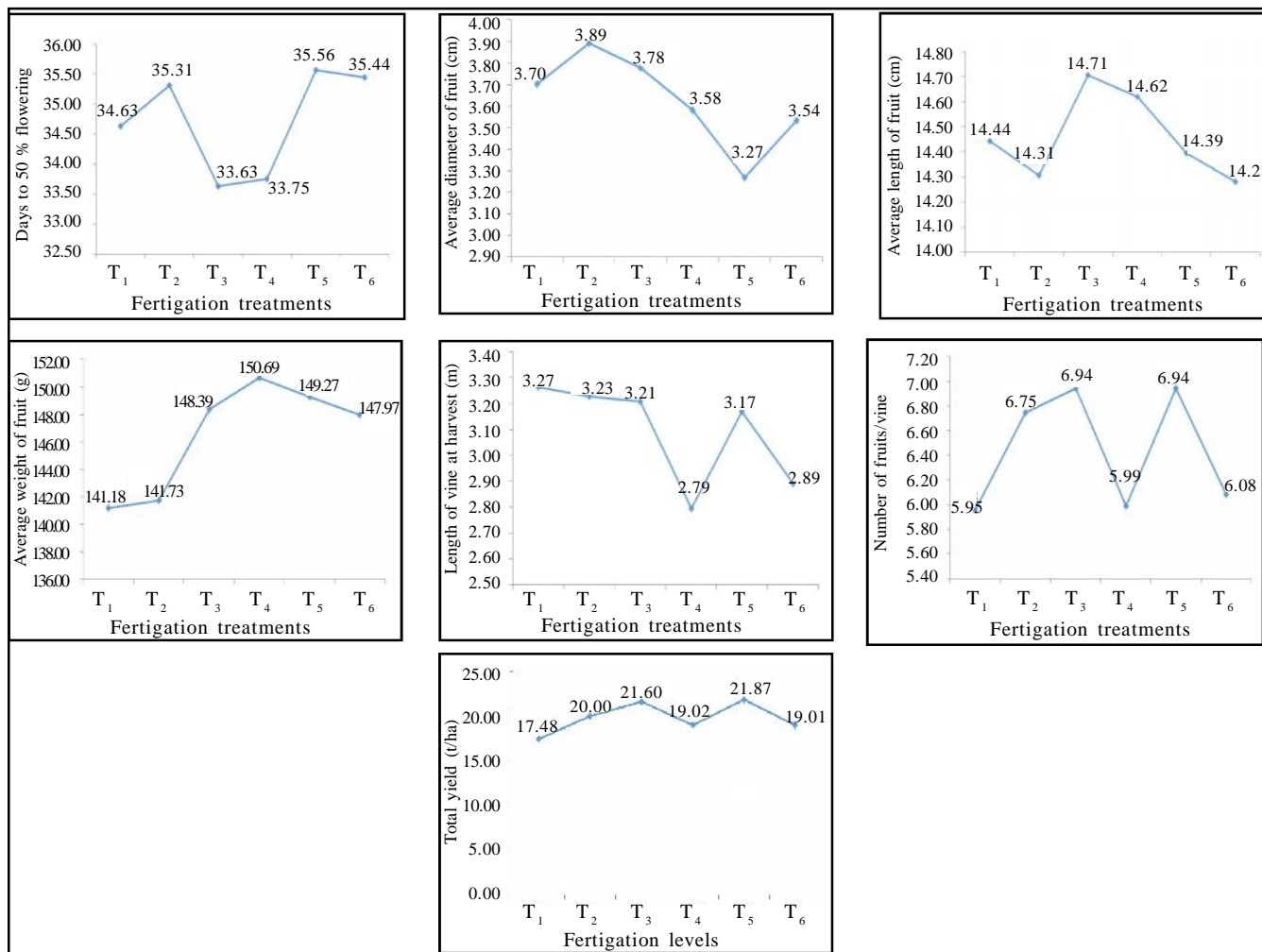


Fig. 1 : Effect of fertilization on biometric observations

Days to 50 per cent flowering :

Minimum days required for 50 per cent flowering were observed with application of 125 per cent N through drip and soil application of P and K *i.e.* treatment T₃ (33.63).

Average diameter of fruit :

The maximum average diameter of the fruit was observed with application of 100 per cent N through drip and soil application of P and K *i.e.* T₂ (3.89 cm).

Average length of fruit :

The maximum average length of fruit (14.71 cm) was observed with application of 125 per cent N through drip and soil application of P and K *i.e.* treatment T₃ and minimum length of fruit (14.28 cm) was observed with application of NPK ratio as per

the crop growth stages with 125 per cent N *i.e.* treatment T₆.

Average fruit weight :

The maximum average fruit weight (150.69 g) was recorded with application of 100 per cent NPK through drip *i.e.* treatment T₄.

Length of vine :

The maximum length of vine (3.27 m) was observed with soil application of NPK (control) *i.e.* treatment T₁. The minimum length of vine (2.79 m) recorded application of 100 per cent NPK through drip *i.e.* treatment T₄.

Number of fruits :

The maximum number of fruits was observed in *i.e.* treatment T₃ (6.94) and with application of 125 per

cent NPK through drip *i.e.* treatment T₅ (6.94).

Yield of fruit :

The maximum yield of fruit per vine was observed with application of 125 per cent NPK through drip *i.e.* treatment T₅ (1.14 kg) which is 21.87 t/ha.

Fertilizer use efficiency :

In shade net with 35 per cent shading, FUE ranged from 34.79 to 62.29 kg/kg and maximum FUE was recorded with application of 125 per cent NPK through drip *i.e.* treatment T₅. In shade net with 50 per cent shading, FUE ranged from 35.53 to 65.55 kg/kg and maximum FUE was recorded with application of 100 per cent NPK through drip *i.e.* treatment T₄. Furthermore, in shade net with 75 per cent shading, FUE ranged from 37.07 to 68.73 kg/kg and maximum FUE was recorded with application of 100 per cent NPK through drip *i.e.* treatment T₄. Lowest FUE was observed from control treatment.

Conclusion :

Irrespective of growing condition, application of 125 per cent NPK through drip irrigation system and application of 125 per cent N through drip irrigation and soil application P and K as basal dose also resulted in higher yield of (21.87 t ha⁻¹) and (21.61 t ha⁻¹), respectively. In shade net with 35 per cent shading, the FUE ranged from 34.79 to 62.29 kg/kg while in shade net with 50 per cent shading, the FUE ranged from 35.53 to 65.55 kg/kg and in shade net with 75 per cent shading, FUE ranged from 37.07 to 68.73 kg/kg. The maximum FUE was observed with 100 per cent NPK through drip irrigation system (68.73 kg/kg). Drip irrigation with 125 per cent NPK through fertigation recorded maximum net returns. Thus, it can be concluded that maximum yield of cucumber grown under shade net with 75 per cent shading can be obtained with application of 125 per cent NPK through drip under Rahuri condition in summer.

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