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Effect of different levels of irrigation and fertigation on growth, physiology, yield attributes and yield of intra hirsutum Bt cotton

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Abstract
A field experiment was conducted at Agricultural Research Station Dharwad, Karnataka, with randomized block design during *kharif* 2015-16 to assess the effect of different levels of irrigation and fertigation on yield of Bt cotton. The results revealed that all the growth and physiological parameters *viz.,* total dry matter production per plant, leaf area index, leaf area duration, chlorophyll content in leaf and yield attributes *viz.,* sympodial branches, bolls per plant and seed cotton yield per plant were enhanced by drip irrigation and fertigation levels and was found maximum at paired sowing with drip irrigation at 1.0 Etc recorded significantly higher seed cotton yield per hectare (3606 kg ha^{-1}) over 0.6 Etc. But it was comparable with 0.8 Etc (3435 kg ha^{-1}). Fertigation of 100 per cent RD N and K (150:75 NP_2O_5 kg ha^{-1}) in six equal splits was recorded significantly higher seed cotton yield per hectare (3654 kg ha^{-1}), as compared to 50 per cent RD N and K. But it was on par with 75 per cent RD N and K (3472 kg ha^{-1}). The interaction effects of the different irrigation and fertigation levels had significant effect on seed cotton yield. However, the 1.0 Etc irrigation level with fertigation of 100 per cent RD N and K (I_1F_1) in six equal split application recorded significantly higher seed cotton yield (4024 kg ha^{-1}), and it was on par with drip irrigation at 0.8 Etc with 100 per cent RD N and K (I_2F_1), 1.0 Etc with 75 per cent RD N and K (I_1F_2) and 0.8 Etc with 75 per cent RD N and K (I_2F_2). Drip irrigation at 1.0 Etc with basal dose of 100 per cent RDF in single row planting system (C_1) was recorded significantly higher seed cotton yield per hectare (2943 kg ha^{-1}) than C_2 (2352 kg ha^{-1}).

Keywords: drip irrigation, fertigation, seed cotton yield

Introduction
Cotton enjoys a predominant position among all cash crops in India. Cotton is an important raw material for the Indian textile industry, constituting about 65% of its requirements. The Indian textile industry occupies a significant place in the country's economy. Among several factors responsible for crop production fertilizers and irrigation play an important role. Bt cotton being highly exhaustive crop with regard to plant nutrients, fairly large quantities of nutrients are required (Satyanarayana and Setty, 2002). Moisture is one of the important factors for crop production. Because of non judicious method of irrigation, considerable amount of water is being wasted by seepage and deep percolation below the root zone resulting in loss of valuable plant nutrients through leaching. Fertigation has been developed specifically for conditions of intensive crop production. Nutrients are applied to the root zone through fertigation in readily soluble forms where root activity tends to be concentrated to improve the fertilizer use efficiency over broadcast application. Conventional method of fertilizer application to soil results in sub optimal use of precious fertilizers. Ever since the fertigation was used in crop production, it was achieved through drip irrigation.

Materials and Methods
A field experiment was conducted during *kharif* 2015 at Agriculture Research Station, Dharwad farm to assess the effect of different levels of drip irrigation and fertigation of N & K on seed cotton yield and water use efficiency as against the furrow method of irrigation and tradition method of fertilizer application. The soil of the experimental site was medium deep black soil with medium organic carbon (0.56%) and neutral soil reaction (7.1). The soil available N, P_2O_5 and K_2O were in low (285 kg ha^{-1}), medium (35 kg ha^{-1}) and high (525 kg ha^{-1}) range respectively. The experiment was laid out in factorial randomized block design and was replicated thrice.

First class BG-II hybrid was sown during first week of June at a spacing 120 cm (60 cm-120 cm) × 60 cm under paired row system of planting and 90 cm × 60 cm with single row planting was followed under control treatments. The experiment consisted of eleven treatments *viz*., I_1F_1 : drip irrigation (DI) at 1.0 Etc with 100% RD N & K fertigation, I_1F_2 : DI at 1.0 Etc with 75% RD N & K fertigation, I_1F_3 : DI at 1.0 Etc with 50% RD N & K fertigation, I_2F_1: DI at 0.8 Etc with 100 % RD N & K fertigation, I_2F_2 : DI at 0.8 Etc with 75% RD N & K fertigation, I_2F_3 : DI at 0.8 Etc with 50% RD N & K fertigation, I_3F_1 : DI at 0.6 Etc with 100% RD N & K fertigation, I_3F_2 : DI at 0.6 Etc with 75% RD N & K fertigation, I_3F_3: DI at 0.6 Etc with 50% RD N & K fertigation, C_1 : drip irrigation at 1.0 Etc with basal application of 100% RDF and C_2 : furrow irrigation at 0.8 IW/ CPE ratio with basal application of 100% RDF.

Scheduling of irrigation was undertaken on the basis of crop coefficient factors during cotton growth period and pan coefficient at every three days interval by considering rainfall using the formula V = E0 × Kc × Kp where V: Volume of water to be given through drip (lit), E0: Pan evaporation of two days (mm), Kc: Crop Coefficient factors during cotton growth period, Kp: Pan factor (0.70). For cotton crop the Kc values were 0.45, 0.75, 1.15 and 0.70 for seedling (0-25 DAS), crop development stage (26-70 DAS), boll development (71-120 DAS) and maturity stage (121 DAS to at harvest) respectively as per FAO Irrigation Water Management Training Manual No 3 (1986). Quantity of water to be applied to each treatment once in three days was calculated using the above equation and accordingly irrigation was scheduled. WUE (kg ha-cm^{-1}) was estimated by using equation *i.e.*, economic crop yield (kg ha^{-1})/water used (ha-cm) and consumptive use of water (mm) was estimated at 30 cm depth by using formula IR + ER + S Mbi - Mai / 100 x BDi x Di where IR= Irrigation water applied (mm), ER= Effective rainfall (mm), Mbi = Moisture percentage at the time of planting in ith layer, Mai = Moisture percentage after harvesting of crop in ith layer, BDi = Bulk density of ith layer (g cc^{-1}) and Di = Depth of ith layer (mm). Fertigation was given in six equal splits at 15 days interval and during the crop growth period a total of 326 mm of effective rainfall was received.

Results and Discussion

The results of the present study as well as relevant discussion have been summarized under following heads:

Growth parameters

The data pertaining to growth and yield parameters of Bt cotton *viz*., plant height, total dry matter per plant, No. of sympodial branches per plant, No. of bolls per plant, boll weight, seed cotton yield per plant and seed cotton yield (kg ha^{-1}) as influenced by different levels of irrigation and fertigation are presented in Table 1. The results revealed that increase in growth attributes with each level of irrigation and fertigation. Total dry matter accumulation increased significantly with irrigation and fertigation, irrigating at 1.0 Etc recorded significantly higher total dry matter accumulation at harvest (153.56 g plant^{-1}) over 0.8 Etc and 0.6 Etc and with fertigation of 100 per cent RD N and K in six equal splits recorded significantly higher total dry matter accumulation at harvest (159 g plant^{-1}) over 75 per cent and 50 per cent RD N and K. Bhalerao *et al.,* (2011) [5] reported higher dry matter accumulation when fertilizers were applied through fertigation in splits. Where I_1F_1 recorded significantly higher total dry matter accumulation (180 g plant^{-1}) and it was comparable with I_2F_1. Drip irrigation at 1.0 Etc with basal dose of 100 per cent RDF in single row planting system (C_1) was recorded significantly higher total dry matter accumulation at harvest (128.67 g plant^{-1}) as compared to C_2 (96.67 g plant^{-1}). The favourable increase in growth attributes in terms of dry matter accumulation due to drip fertigation was reported by Ayyadurai and Manickasundaram (2014) [2]. Veeraputhiran (2000) [11], Sathyaprakash (2007) [12], Nalayani *et al.,* (2012), Gokila (2012) [13] and Ayyadurai and Manickasundaram (2014) [2] also reported that application of nutrients in more split enhanced the dry matter production.

Physiological parameter

As indicated in Table 2 and 3 the physiological characters like leaf area index (LAI), chlorophyll content in leaf (SPAD value) and leaf area duration (LAD) at 60 to 90DAS, 90 to 120 DAS, 120 to 150 DAS and 150 to at harvest influenced significantly due to different irrigation and fertigation levels. Significantly higher leaf area index and SPAD value were recorded at 60, 90, 120, 150 DAS and at harvest (1.83, 2.41, 2.94, 2.53 and 1.28, respectively) and (35.71, 40.33, 36.81, 36.22 and 30.11, respectively) over 0.6 Etc. But it was comparable with 0.8 Etc. Fertigation of 100 per cent RD N and K in six equal splits was recorded significantly higher leaf area index and SPAD value at 60, 90, 120, 150 DAS and at harvest (1.73, 2.52, 2.97, 2.57 and 1.31, respectively) and (36.44, 41.44, 37.70, 37.11 and 30.67, respectively) over 50 per cent RD N and K but it was comparable with 75 per cent RD N and K. Among the interactions I_1F_1 was recorded significantly higher leaf area index and SPAD value at all the growth stages. However, it was comparable with I_2F_1, I_1F_2 and I_2F_2. C_1 was recorded significantly higher leaf area index and SPAD value at all the growth stages as compared to C_2. SPAD values were significantly influenced by irrigation and fertigation levels. Irrigating at 1.0 Etc with fertigation of 100% RD N & K in six equal splits has resulted in significantly higher SPAD value at all the growth stage over other lower nutrient levels. The results are similar with the findings of Brar *et al.* (2002) [14] and Hallikeri *et al.* (2011) [9] indicated that status of chlorophyll content in leaf was affected by nitrogen. Ayyadurai and Manickasundaram (2014) [2] also stated that fertigation with higher levels of nutrients reported higher LAI. Jayakumar *et al.* (2015) [5] indicated that LAI increased slowly in early stages of crop growth and rapidly after seedling stages.

Higher leaf area index were noticed at 60-90, 90-120, 120-150, 150 DAS-at harvest (63.48, 80.17, 82.08 and 57.17**,** respectively) over 0.6 Etc and 0.8 Etc. fertigation of 100 per cent RD N and K recorded significantly higher leaf area duration at 60-90 DAS and it was comparable with 75 per RD N and K. And at later stages it was non-significant with 75 per RD N and K. The interaction effects of the different irrigation and fertigation levels had significant effect on leaf area index. I_1F_1 was recorded significantly higher leaf area duration at 60-90, 90-120 and 120-150 (70.45, 90.20 and 91.70, respectively). However, it was comparable with I_2F_1, I_1F_2 and I_2F_2. C_1 was recorded significantly higher leaf area duration at 60-90, 90-120, 120-150, 150 DAS-at harvest (50.50, 66.65, 70.15 and 50.00, respectively) as compared to C_2.

Yield attributes and yield

Higher number of sympodia per plant, total number of bolls per plant, boll weight and seed cotton yield per plant with

scheduling of irrigation at 1.0 Etc (18.5, 40.9, 6.8 and 235.8, respectively) which was significantly higher than 0.6 Etc. However, it was comparable with 0.8 Etc (17.7, 38.1, 6.4 and 227.9, respectively). Significantly higher number of sympodia per plant, total number of bolls per plant, boll weight and seed cotton yield per plant were obtained with fertigation of 100 per cent RD N & K in six equal splits (19.4, 41.6, 7.2 and 240, respectively) as compared to 50 per cent RD N and K, however it was on par with 75 per cent RD N and K (18.5, 39.06, 6.5 and 229.3 respectively). These results are in agreement with findings of Bhalerao *et al.* (2011) [5] who reported that the yield attributes of Bt cotton were improved with the application of more nutrients. Though the interaction effect was significant, irrigating at 1.0 Etc with fertigation of 100 per cent RD N and K (I_1F_1) in six equal splits was registered significantly higher number of sympodia per plant (21.3) and it was on par with 0.8 Etc irrigation level with fertigation of 100 per cent RD N and K (I_2F_1) (20.9). Irrigating at 1.0 Etc with fertigation of 100 per cent RD N and K (I_1F_1) in six equal splits recorded significantly higher number of total bolls per plant, boll weight and seed cotton yield per plant (47.9, 7.9 and 279.3, respectively) and it was on par with drip irrigation at 0.8 Etc with fertigation of 100 per cent RD N & K (I_2F_1), drip irrigation at 1.0 Etc with fertigation of 75 per cent RD N and K (I_1F_2), and drip irrigation at 0.8 Etc with fertigation of 75 per cent RD N and K (I_2F_2). Drip irrigation at 0.6 Etc with fertigation of 50 per cent RD N and K (I_3F_3) was recorded significantly lower number of sympodia per plant, total bolls per plant, boll weight and seed cotton yield per plant as compared to rest of the treatments (13.7, 24.8, 5.3 and 147.3, respectively). The results are in conformity with earlier reports of Basavanneppa (2012) and Jayakumar *et al. (*2015) [7] who reported improvement in the yield attributes of cotton under drip fertigation. This may be due to enhanced availability and uptake of nutrients leading to enhanced photosynthesis, expansion of leaves and translocation of nutrients to reproductive parts compared to conventional method of soil application of nutrients. Drip irrigation at 1.0 Etc with basal dose of 100 per cent RDF in furrow planting system (C_1) recorded significantly higher number of sympodia per plant, total bolls per plant, boll weight and seed cotton yield per plant (16.2, 36.4, 6.7 and 155.3, respectively) as compared to furrow irrigation with basal dose of 100 per cent RDF in single row planting system (C_2). Seed cotton yield increased with each level of irrigation where in drip irrigation at 1.0 Etc registered significantly higher seed cotton yield (3606 kg ha^{-1}) as compared to 0.6 Etc., but it was on par with 0.8 Etc (3435 kg ha^{-1}). The findings are in conformity with results of Rajendran and Arunvenkatesh (2014) [10] and Bhalerao *et al.* (2011) [5] who reported higher number of bolls, sympodial branches per plant and seed cotton yield per plant with scheduling of drip irrigation at 1.0 Etc. Aladakatti *et al.* (2012) [1] also reported that drip irrigation at 80% PE once in 3 days interval increased the seed cotton yield and WUE when compared to other drip irrigation treatments. This was mainly due to limited quantity of water applied, increased seed cotton yield and favourable micro-climate. Seed cotton yield increased with each level of fertigation levels. Paired row sowing with fertigation of 100 per cent RD N & K (150:75 kg ha^{-1}) in six equal splits recorded significantly higher seed cotton yield (3,654 kg ha^{-1}), as compared to 50 per cent RD N and K., but it was on par with 75 per cent RD N and K (3,472 kg ha^{-1}). The results are in conformity with the findings of Balasubramanian *et al.* (2000) [3]: Bhakare *et al.* (2015) [6]: Nalayini *et al.* (2012) [8] who reported 25 per cent fertilizer saving through drip fertigation to cotton and opined that as nutrients are supplied along with the water in the root zone through drip system, root proliferation was greater resulting in enhanced uptake of nutrients and water. The interaction effects had significant effect on seed cotton yield. Irrigating at 1.0 Etc with fertigation of 100 per cent RD N & K (I_1F_1) in six equal split application recorded significantly higher seed cotton yield (4,024 kg ha^{-1}), and it was on par with drip irrigation at 0.8 Etc with 100 per cent RD N and K (I_2F_1), 1.0Etc with 75 per cent RD N and K (I_1F_2) and 0.8 Etc with 75 per cent RD N and K (I_2F_2). Drip irrigation at 0.6 Etc with fertigation of 50 per cent RD N and K (I_3F_3) recorded significantly lower SCY as compared to all other treatments. Drip irrigation at 1.0 Etc with fertigation of 100 per cent RD N & K (I_1F_1), drip irrigation at 0.8 Etc with fertigation of 100 per cent RD N & K (I_2F_1), drip irrigation at 1.0 Etc with fertigation of 75 per cent RD N and K (I_1F_2), and drip irrigation at 0.8 Etc with fertigation of 75 per cent RD N and K (I_2F_2) (4024, 4014, 3978 and 3943 kg ha^{-1}) were registered significantly superior SCY as compared to control plots C_1 and C_2. However drip irrigation at 1.0 Etc with basal dose of 100 per cent RDF in single row planting system (C_1) recorded significantly higher seed cotton yield (2,943 kg ha^{-1}) than C_2 (2,352 kg ha^{-1}).

Table 1: Growth, yield parameters and seed cotton yield of Bt cotton as influenced by irrigation and fertigation levels.

Treatment	Plant height (cm)	Total dry matter (g $plant^{-1}$)	Number of sympodia per plant	Total bolls $plant^{-1}$	Boll weight (g)	SCY per plant (g)	SCY (kg ha^{-1})
Irrigation levels (I)							
I_1: 1.0 Etc	97.07	153.56	18.47	40.89	6.8	235.8	3606
I_2 : 0.8 Etc	89.07	145.33	17.73	38.07	6.5	227.9	3435
I_3 : 0.6 Etc	80.24	106.11	15.02	29.19	5.9	159.6	2583
S. Em±	3.30	2.69	0.31	1.12	0.12	5.71	101
CD at 5%	9.90	8.08	0.91	3.34	0.35	17.10	302
Fertigation levels (F)							
F_1 : 100 % RD N & K	98.51	159.00	19.38	41.58	7.2	240.0	3654
F_2 : 75 % RD N & K	90.31	148.44	18.50	39.06	6.9	229.3	3472
F_3 : 50 % RD N & K	77.56	97.56	14.49	27.51	5.4	153.9	2499
S. Em±	3.30	2.69	0.31	1.12	0.12	5.71	101
CD at 5%	9.90	8.08	0.91	3.34	0.35	17.10	302
Interactions (I x F)							
I_1F_1	110.33	180.00	21.27	47.87	7.9	279.3	4024
I_1F_2	96.73	169.33	18.47	43.20	7.4	265.7	3978
I_1F_3	84.13	111.33	15.67	31.60	5.6	162.3	2814
I_2F_1	97.87	175.33	20.87	45.40	7.7	270.0	4014

I_2F_2	93.67	167.33	18.20	42.67	7.4	261.7	3943
I_2F_3	75.67	93.33	14.13	26.13	5.5	152.0	2348
I_3F_1	87.33	121.67	16.00	31.47	6.5	170.7	2923
I_3F_2	80.53	108.67	15.40	31.30	5.9	160.7	2493
I_3F_3	72.87	88.00	13.67	24.80	5.3	147.3	2334
S. Em±	5.72	4.67	0.53	1.93	0.20	9.88	175
C. D.5%	NS	13.99	1.58	5.79	0.61	29.63	523
Controls							
C_1	90.67	128.67	16.20	36.40	6.7	186.7	2943
C_2	79.67	96.67	14.73	26.93	5.8	155.3	2352
S. Em±	5.24	4.27	0.48	2.02	0.20	9.58	167
CD at 5%	15.45	12.59	1.42	5.97	0.59	28.27	491

Irrigation Levels	**Fertigation levels (F)**
I_1: 1.0 Etc	F_1 : 100 % RD N & K (150: 75: 75 kg ha^{-1})
I_2 : 0.8 Etc	F_2 : 75 % RD N & K (112.5: 75: 56.25 kg ha^{-1})
I_3 : 0.6 Etc	F_3 : 50 % RD N & K (75: 75: 37.5 kg ha^{-1})
Controls	
C_1: Drip irrigation at 1.0 Etc + 100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).	
C_2: Furrow Irrigation at 0.8 IW/CPE ratio +100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS	

Table 2: Leaf area index of Bt cotton as influenced by irrigation and fertigation levels at different growth stages.

Treatment	**Leaf area index**				
	60 DAS	**90 DAS**	**120 DAS**	**150 DAS**	**At harvest**
Irrigation levels (I)					
I_1: 1.0 Etc	1.83	2.41	2.94	2.53	1.28
I_2 : 0.8 Etc	1.54	2.27	2.77	2.35	1.18
I_3 : 0.6 Etc	0.96	1.78	2.10	1.91	0.80
S. Em±	0.11	0.07	0.10	0.06	0.04
CD at 5%	0.33	0.20	0.29	0.18	0.13
Fertigation levels (F)					
F_1 : 100 % RD N & K	1.73	2.52	2.97	2.57	1.31
F_2 : 75 % RD N & K	1.60	2.31	2.81	2.45	1.18
F_3 : 50 % RD N & K	0.99	1.63	2.03	1.78	0.77
S. Em±	0.11	0.07	0.10	0.06	0.04
CD at 5%	0.33	0.20	0.29	0.18	0.13
Interactions (I x F)					
I_1F_1	2.00	2.70	3.31	2.80	1.53
I_1F_2	1.92	2.58	3.20	2.67	1.40
I_1F_3	1.00	1.93	2.30	2.13	0.90
I_2F_1	1.97	2.67	3.27	2.77	1.47
I_2F_2	1.91	2.57	3.12	2.62	1.30
I_2F_3	0.73	1.57	1.92	1.67	0.77
I_3F_1	1.23	2.00	2.34	2.13	0.93
I_3F_2	0.97	1.77	2.12	2.07	0.83
I_3F_3	0.67	1.38	1.85	1.53	0.63
S. Em±	0.19	0.12	0.17	0.11	0.08
CD at 5%	0.57	0.35	0.51	0.32	0.23
Controls					
C_1	1.33	2.03	2.41	2.27	1.07
C_2	0.77	1.63	1.93	1.83	0.80
S. Em±	0.18	0.12	0.16	0.11	0.07
CD at 5%	0.54	0.35	0.46	0.32	0.21

Irrigation Levels	**Fertigation levels (F)**
I_1: 1.0 Etc	F_1 : 100 % RD N & K (150: 75: 75 kg ha^{-1})
I_2 : 0.8 Etc	F_2 : 75 % RD N & K (112.5: 75: 56.25 kg ha^{-1})
I_3 : 0.6 Etc	F_3 : 50 % RD N & K (75: 75: 37.5 kg ha^{-1})
Controls	
C_1: Drip irrigation at 1.0 Etc + 100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).	
C_2: Furrow Irrigation at 0.8 IW/CPE ratio +100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS)	

Table 3: SPAD values of Bt cotton as influenced by irrigation and fertigation levels at different growth stages.

Treatment	**SPAD Values**				
	60 DAS	**90 DAS**	**120 DAS**	**150 DAS**	**At harvest**
Irrigation levels (I)					
I_1: 1.0 Etc	35.71	40.33	36.81	36.22	30.11
I_2 : 0.8 Etc	32.22	37.78	34.89	34.56	27.33
I_3 : 0.6 Etc	23.89	29.22	26.78	29.33	22.44
S. Em±	1.22	1.41	1.47	0.80	1.04

CD at 5%	3.67	4.21	4.40	2.40	3.12
Fertigation levels (F)					
F_1 : 100 % RD N & K	36.44	41.44	37.70	37.11	30.67
F_2 : 75 % RD N & K	33.38	38.78	35.00	34.78	27.67
F_3 : 50 % RD N & K	22.00	27.11	25.78	28.22	21.56
S. Em±	1.22	1.41	1.47	0.80	1.04
CD at 5%	3.67	4.21	4.40	2.40	3.12
Interactions (I x F)					
I_1F_1	42.33	46.00	43.10	40.00	33.67
I_1F_2	38.13	43.33	39.00	38.33	31.00
I_1F_3	26.67	31.67	28.33	30.33	25.67
I_2F_1	39.00	45.67	41.00	39.00	32.00
I_2F_2	37.00	42.33	38.33	37.00	30.00
I_2F_3	20.67	25.33	25.33	27.67	20.00
I_3F_1	28.00	32.67	29.00	32.33	26.33
I_3F_2	25.00	30.67	27.67	29.00	22.00
I_3F_3	18.67	24.33	23.67	26.67	19.00
S. Em±	2.12	2.43	2.54	1.39	1.80
CD at 5%	6.36	7.30	7.62	4.16	5.41
Controls					
C_1	30.33	33.00	29.67	32.67	24.33
C_2	25.67	27.67	24.00	28.67	21.00
S. Em±	2.29	2.25	2.34	1.45	1.67
CD at 5%	6.74	6.63	6.89	4.27	4.94
Irrigation Levels	**Fertigation levels (F)**				
I_1: 1.0 Etc	F_1 : 100 % RD N & K (150: 75: 75 kg ha^{-1})				
I_2 : 0.8 Etc	F_2 : 75 % RD N & K (112.5: 75: 56.25 kg ha^{-1})				
I_3 : 0.6 Etc	F_3 : 50 % RD N & K (75: 75: 37.5 kg ha^{-1})				
Controls					
C_1: Drip irrigation at 1.0 Etc + 100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).					
C_2: Furrow Irrigation at 0.8 IW/CPE ratio +100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).					

Table 4: Leaf area duration of Bt cotton as influenced by irrigation and fertigation levels at different growth stages.

Treatment	Leaf area duration			
	60-90DAS	90-120 DAS	120-150 DAS	150 DAS-At harvest
Irrigation levels (I)				
I_1: 1.0 Etc	63.48	80.17	82.08	57.17
I_2 : 0.8 Etc	57.10	75.53	76.78	52.92
I_3 : 0.6 Etc	41.00	58.28	60.20	40.67
S. Em±	1.58	1.94	1.69	1.25
CD at 5%	4.73	5.82	5.06	3.75
Fertigation levels (F)				
F_1 : 100 % RD N & K	63.85	82.42	83.08	58.17
F_2 : 75 % RD N & K	58.57	76.77	78.93	54.42
F_3 : 50 % RD N & K	39.17	54.80	57.05	38.17
S. Em±	1.58	1.94	1.69	1.25
CD at 5%	4.73	5.82	5.06	3.75
Interactions (I x F)				
I_1F_1	70.45	90.20	91.70	65.00
I_1F_2	67.50	86.75	88.00	61.00
I_1F_3	52.50	63.55	66.55	45.50
I_2F_1	69.60	89.00	90.50	63.50
I_2F_2	67.20	85.25	86.00	58.75
I_2F_3	34.50	52.35	53.85	36.50
I_3F_1	51.50	68.05	67.05	46.00
I_3F_2	41.00	58.30	62.80	43.50
I_3F_3	30.50	48.50	50.75	32.50
S. Em±	2.73	3.36	2.92	2.15
CD at 5%	8.20	10.08	8.76	NS
Controls				
C_1	50.50	66.65	70.15	50.00
C_2	36.00	53.50	56.50	39.50
S. Em±	2.93	3.18	2.74	2.15
CD at 5%	8.64	9.39	8.08	6.34
Irrigation Levels	**Fertigation levels (F)**			
I_1: 1.0 Etc	F_1 : 100 % RD N & K (150: 75: 75 kg ha^{-1})			
I_2 : 0.8 Etc	F_2 : 75 % RD N & K (112.5: 75: 56.25 kg ha^{-1})			
I_3 : 0.6 Etc	F_3 : 50 % RD N & K (75: 75: 37.5 kg ha^{-1})			

Controls
C_1: Drip irrigation at 1.0 Etc + 100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).
C_2: Furrow Irrigation at 0.8 IW/CPE ratio +100 % RD N & K in 4 splits through soil (25 % each as basal and at 30, 60 & 90 DAS).

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