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Studies on drip irrigation levels on growth, flowering and yield of alstroemeria (*Alstroemeria hybrida* L.)

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Abstract
The present study was carried out at the experimental farm of the Department of Floriculture and Landscape Architecture of Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan under naturally ventilated polyhouse conditions during 2014-15 and 2015-16. The experiment was laid out in a Randomized Block Design having 10 treatments of drip irrigation levels replicated thrice. The observations on various growth, flowering and yield were recorded at the time of peak flowering. The pooled data revealed that, maximum values *w.r.t.* plant height (97.23 cm), stem length (92.25 cm), stem thickness (8.45 mm), number of shoots per plant (46.21), number of leaves per plant (41.26), number of flowers per stem (17.95), number of flowers per cyme (5.69), inflorescence diameter (9.28 cm), vase life (20.28 days) as well as yield per plant (43.18 cut stems) in those plants which received T_{10} treatment *i.e.* 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September). As regards the effect of flushes, the pooled data also revealed the maximum plant height (110.66 cm), stem length (106.27 cm), stem thickness (7.67 mm), number of shoots per plant (50.87), highest number of leaves per stem (42.74), maximum number of flowers per stem (17.20), number of flowers per cyme (4.72), inflorescence diameter (8.75 cm), higher vase life (17.19 days) as well as yield per plant (43.80 cut stems) was recorded in 1st flush. The interaction, $T_{10}\times B_1$ *i.e.* when plants were irrigated with 10 litres/m^2 (October-February) and 12.5 litres/m^2 (March-September) during 1st flush recorded maximum values in terms of most of the growth and flowering parameters of commercial importance. Hence, it is concluded that for better growth, flowering and yield of cut flowers, the alstroemeria plants be irrigated with the 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September).

Keywords: drip irrigation, growth, flowering, yield and alstroemeria

Introduction
Alstroemeria (*Alstroemeria hybrida* L.) is an important bulbous ornamental plant of great commercial value and belongs to family alstroemeriaceae. It is native to South America and commonly known as 'the Peruvian Lily' or 'Lily of Incas'. The genus *Alstroemeria* has about 93 species mostly found in Chile and Brazil. A large number of cultivars have been bred through hybridization and mutagenesis and being cultivated for cut flower production, pot plant and outdoor planting mainly in the Netherlands, Colombia, U.S.A., England, France, Kenya, Japan and other countries.
Though, alstroemeria is a recent introduction in the world floriculture trade but it is gaining popularity in the global perspective mainly due to the reason that it has large number of cultivars in a variety of colours, ease in cultivation besides the fact that its cut flowers have long lasting vase life over two to three weeks. Therefore, alstroemeria has attained the status of one of the most important cut flower of the world. Besides cut flowers and pot plants, alstroemeria is also gaining popularity for being growing as an important bedding plant, in containers for the decks, patios as well as in the various landscapes and bulbous gardens particularly in the temperate regions. Hence, alstroemeria has attained position among the top ten cut flowers, pot plants as well as outdoor plants traded in the Aalsmeer market (NHB, 2015) [1].
Alstroemeria is a rhizomatous monocot plant and prefers to grow more luxuriantly and flower profusely in the cool and moist climatic conditions. Alstroemeria plant consists of sympodial fleshy multi-stemmed rhizomes from which aerial shoots and fibrous roots arise (Gupta and Gupta, 2007) [2]. As the plants develops, the fibrous roots become thickened storage roots. These storage roots, called 'Redices medullosae' are long, thick, white, fleshy, very brittle and densely haired. The shoots can be either reproductive or vegetative depending upon the environmental conditions.

Alstroemeria shoots produce a whorled cymose inflorescence and each cyme is sympodially branched with up to four florets per cyme that open one after another. The sexual parts of the flowers are dichogamous, the stamens open and shed their pollens before the stigma becomes receptive. Fruits are sometimes fleshy or non-fleshy, dehiscent or indehiscent, usually a capsule or capsular – indehiscent or a berry.

Alstroemeria being a rhizomatous monocot plant and it prefers to be grown in a cool and moist climate. So, it warrants continuously for requisite level of moisture througthout the growing medium uniformly for its luxuriant growth and profuse flowering. Therefore, irrigation regimes need to be worked out to increase the yield and quality of cut flowers of alstroemeria. Among all the irrigation methods, the drip irrigation is the most efficient and can be practised in a large variety of crops, especially in vegetables, orchard crops, flowers and plantation crops. In drip irrigation, water is applied near the plant roots through emitters or drippers, on or below the soil surface, at a low rate varying from 2 - 20 litres per hour. The soil moisture is kept at an optimum level with frequent irrigations. Drip irrigation results in a very high water application efficiency of about 90-95 per cent. Since, there is scanty information on the effect of drip irrigation level(s) on growth and flowering of alstroemeria particularly in Indian conditions. Hence, need has been felt to standardize the suitable drip irrigation levels for alstroemeria in the mid hill conditions of H.P. for the commercialization of this crop owing to the reasons that drip irrigation plays a vital role in obtaining the better growth, flowering, improving the yield and quality of cut flowers of alstroemeria.

So, keeping in view the above facts, the present investigation entitled, "Effect of drip irrigation levels on growth and flowering of alstroemeria (*Alstroemeria hybrida* L.)" was carried out with the objective to work out the suitable irrigation level for better growth, flowering and quality of alstroemeria.

Materials and Methods

To accomplish the present study, the experiment was laid out in a randomized block design consisting of 10 treatments replicated thrice. The details of treatments were T_1 = Surface irrigation (October- September), T_2 = 4 litres/m^2 (October-September), T_3 = 6 litres/m^2 (October- September), T_4 = 8 litres/m^2 (October-September), T_5 = 10 litres/m^2 (October-September), T_6 = Surface irrigation (Oct- Feb) and 125% surface irrigation (March- September), T_7 = 4 litres/m^2 (Oct-Feb) and 5 litres/m^2 (March-September), T_8 = 6 litres/m^2 (Oct-Feb) and 7.5 litres/m^2 (March-September), T_9 = 8 litres/m^2 (Oct- Feb) and 10 litres/m^2 (March-September) and T_{10} = 10 litres/m^2 (Oct- Feb) and 12.5 litres/m^2 (March-September).

The selected healthy and disease free plants of alstroemeria (*Alstroemeria hybrida*) cv. ' Capri' were planted at a spacing of 50 cm × 50 cm with a density of four plants per plot having a size of 1 m × 1 m, containing a sterilized growing substrate as detailed above in the poly house on 30 August, 2014. The application of NPK @ 150: 100: 150 ppm through fertigation was applied uniformly after the establishment of plants continuously starting *w.e.f.* 30th September, 2014 up to 10th August, 2016. To maintain the good plant health and obtaining best quality cut flowers, standard plant protection measures were adopted which included fortnightly drenching and spraying with Dithane M-45 @ 2g/l and Bavistin @ 1g/l, alternatively. Besides it, to check the infestation of various insect-pests, a spray of endosulfan @ 2 ml/l and decis @ 1 ml/ l, respectively was practiced alternatively at an interval of 15 days. The standard cultural practices were followed to raise a successful crop which included weeding, hoeing, netting and removal of unwanted stems/shoots etc. The observations were recorded on various growth, flowering, yield and quality parameters.

Results and Discussion

Vegetative parameters

A perusal of data presented in Table 1 and Table 2 indicated that the application of different irrigation treatments and flower flushes had exhibited significant effect on various vegetative parameters of alstroemeria. The pooled data shows that the tallest plants (97.23 cm), maximum stem length (92.25 cm), maximum stem thickness (8.45 mm), maximum number of shoots per plant (46.21) and highest number of leaves per plant (41.26) were recorded in those plants which received T_{10} treatment *i.e*. 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September).

The different flushes had also exhibited significant effects on vegetative parameters. The 1st flush produced tallest plants (107.87 cm), maximum stem length (103.96 cm), maximum stem thickness (7.60 mm), maximum number of shoots per plant (47.31), as well as highest number of leaves per plant (42.72). Among interactions, maximum plant height (117.20 cm), longest stem length (112.73 cm), maximum stem thickness (8.47 mm), maximum number of shoots per plant (59.00) as well as highest number of leaves per plant (47.74) was observed in the interaction, $T_{10}\times B_1$ *i.e.* when plants were irrigated with 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September) in 1st flush.

All the vegetative parameters (*viz*., plant height, stem length, stem thickness, number of shoots per plant and number of leaves per plant) increased linearly with the corresponding increase in water amount applied. This may be attributed to the fact that irrigation of plants with higher amount of water might have played major role in promoting better plant growth and development of higher biomass. More plant growth was in 1st flush because first flush took more time period for vegetative growth and climatic requirements like temperature were quite suitable for the crop during 1st flush as compared to 2nd flush.

The results in general are in agreement with the findings of Fuller *et al*. (1996) who evaluated the evaluation of irrigation/ nutrition requirements in accordance with the stage of growth of plants for a range of commercially grown varieties of alstroemeria. They concluded that high irrigation and high nutrition produced more growth of plants than the standard treatment early and late in the year. Similar findings were also reported by Sánchez-Blanco *et al*. (2009) who studied the response of potted geraniums to different irrigation levels. They concluded that exposure to drought induced a decrease in shoot dry weight and leaf area and an increase in the root/shoot ratio. Similar findings were also reported by Kazaz *et al*. (2010) [4] who investigated the effects of different irrigation water amounts (k_{cp}1: 0.25, k_{cp}2: 0.50, k_{cp}3: 0.75, k_{cp}4: 1.00 and k_{cp}5: 1.25) and irrigation intervals (I_1: 1-, I_2: 2- and I_3: 3-day) on vegetative and quality parameters of carnation plants (*Dianthus caryophyllus* L.) cv. 'Turbo' grown in soil under greenhouse conditions. They interpretated that vegetative and quality parameters (stem length, stem fresh weight, stem thickness, flower diameter and stem diameter) were significantly ($p < 0.01$) affected by the irrigation water amount and irrigation interval as well.

Flowering Parameters

Data recorded for flowering parameters as influenced by various levels of drip irrigation and flushes have been presented in Table 3 and Table 4. Maximum number of flowers per stem (16.88), maximum number of flowers per cyme (5.50), highest inflorescence diameter (9.25 cm), more vase life (20.05 days) as well as cut flower yield per plant (41.19 cut stems) was recorded in those plants which received T_{10} treatment *i.e*. 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September).

As regards the effect of flushes, maximum number of flowers per stem (16.09), number of flowers per cyme (4.67), inflorescence diameter (8.71 cm), more vase life (17.14 days) as well as higher cut flower yield per plant (40.75 cut stems) was recorded in 1st flush. Among interactions, the highest number of flowers per stem (20.75), number of flowers per cyme (6.20), largest diameter inflorescences (9.75 cm), more vase life (20.95 days) as well as cut flower yield per plant (55.14 cut stems) was observed in $T_{10}\times B_1$ *i.e.* when plants were irrigated with 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September) in 1st flush. The more number of cut stems per plant was produced due to availability of more congenial environment, plants produced more shoots in sufficient quantity which later on becomes productive.

The flowering parameters (*viz*., number of flowers per stem, number of flowers per cyme, inflorescence diameter, vase life and yield per plant) improved linearly with the increasing level of drip irrigation irrespective of flushes. However, the improvement was more pronounced with the corresponding increase in drip irrigation level especially in the first flush. The increase in various flowering parameters with the corresponding increase in irrigation water could be ascribed to the fact that with the higher amount of water applied through drip might have ensured requisite and uniform level of moisture content as well as availability of more NPK content in the growing medium throughout. Consequently, the fleshy roots (Radices medullosae) could have absorbed sufficient moisture and available NPK required for the growth, development as well as flowering of alstroemeria. Hence, the plants receiving higher levels of drip irrigation could put requisite plant growth and produced more biomass especially the good quality vegetative shoots which later on turned reproductive. Consequently, the higher cut flower yield was obtained mainly in the first flush during which the climatic conditions particularly the temperature and soil moisture regimes (both vertical and lateral) remained more favourable. Furthermore, it took longer period during first flush for flowering. So, plants could put up higher amount of biomass. Hence, higher and better flowering attributes were observed with the application of more amount of drip irrigation water especially during first flush.

The results in general are in agreement with the earlier findings of Fuller *et al*. (1996) who studied the evaluation of irrigation/ nutrition requirements in relation to the stage of growth for a range of commercially grown varieties of alstroemeria and concluded that high irrigation and high nutrition produced more growth of plants than the standard treatments early and late in the year. Similar findings were also reported by Sánchez-Blanco *et al*. (2009) who investigated the response of potted geraniums to different irrigation levels. They concluded that exposure to drought induced a sharp decrease in shoot dry weight and leaf area and an increase in the root/shoot ratio. Similar findings were also reported by Kazaz *et al*. (2010) [4] who had studied the effects of different irrigation water amounts ($k_{cp}1$: 0.25, $k_{cp}2$: 0.50, $k_{cp}3$: 0.75, $k_{cp}4$: 1.00 and $k_{cp}5$: 1.25) and irrigation intervals (I_1: 1-, I_2: 2- and I_3: 3-day) on vegetative and quality parameters of carnation plants (*Dianthus caryophyllus* L.) cv. 'Turbo' grown in soil under greenhouse conditions. They concluded that vegetative and quality parameters (stem length, stem fresh weight, stem thickness, flower diameter and stem diameter) were significantly ($p < 0.01$) affected by the irrigation water amount and irrigation interval. Lisiecka and Szczepaniak (1992) [6] also studied the various factors influencing the yield of alstroemeria. They concluded that during the time of intensive growth, the plants warrants for abundant and regular watering amounting to 1.5- 2.0 dm^3 of water per plant per week. Differentiated dose of water significantly influenced not only the size but also the quality of the yield and the length of the inflorescence shoot.

The results also got the support of Kittas *et al*. (2005) [5] who investigated the effect of high and low irrigation frequency on flower production and quality of rose. They concluded that with the higher irrigation frequency, there was higher number of cut flowers, since the total number of cut flowers measured at the end of the experimental period was 20.7 and 16.2 flowers per greenhouse m^2 for high and low irrigation frequencies, respectively. Our results are also in agreement with the earlier findings of Aydınsakir *et al*. (2009) [2] who had carried out a study on the effects of different irrigation levels on flowering and flower quality of carnation (*Dianthus caryophyllus* L.) cv. 'Eilat' grown in plastic greenhouse and irrigated by a drip irrigation system under mediterranean (Antalya) conditions. They concluded that high frequency irrigations using high pan coefficients increased flower stem length, flower stem diameter, stem weight, flower diameter, vase life and cut flower yield as compared to low frequency irrigation with lower pan coefficients.

Conclusion

From the present study, it is concluded that for better growth, flowering and yield of cut flowers, the alstroemeria plants be irrigated with the 10 litres/m^2 (October- February) and 12.5 litres/m^2 (March-September).

Table 1: Effect of drip irrigation levels on vegetative parameters of alstroemeria (*Alstroemeria hybrida* L.)

Treatments	Plant height (cm)			Stem length (cm)			Stem thickness (mm)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
T_1	84.45	88.38	86.41	80.78	84.70	82.74	7.35	7.42	7.38
T_2	71.29	75.48	73.38	67.23	70.88	69.06	6.68	6.80	6.74
T_3	76.20	81.30	78.75	71.44	75.30	73.37	6.91	7.17	7.04
T_4	87.47	91.64	89.55	83.39	87.49	85.44	7.91	8.09	7.98
T_5	91.59	96.41	94.00	87.55	91.82	89.70	8.04	8.32	8.18
T_6	86.11	90.72	88.42	82.15	86.61	84.38	7.52	7.73	7.62
T_7	73.35	79.23	76.29	69.03	72.62	70.83	6.80	7.00	6.90
T_8	79.99	85.74	82.87	76.55	80.22	78.39	7.26	7.41	7.34
T_9	89.77	94.54	92.15	85.65	90.27	87.96	7.98	8.16	8.07
T_{10}	94.12	100.34	97.23	89.77	94.74	92.25	8.41	8.48	8.45

$CD_{(0.05)}$	2.28	2.35	1.61	2.19	2.16	1.71	0.36	0.30	0.23
Flushes									
1^{st} Flush (B_1)	107.87	113.44	110.66	103.96	108.57	106.27	7.60	7.74	7.67
2^{nd} Flush(B_2)	59.00	63.31	61.15	54.75	58.37	56.56	7.37	7.57	7.47
$CD_{(0.05)}$	1.02	1.04	0.72	1.21	0.97	0.76	0.16	0.13	0.10
Interactions									
$T_1 \times B_1$	110.67	115.14	112.90	107.42	111.82	109.62	7.45	7.44	7.45
$T_1 \times B_2$	58.23	61.62	59.93	54.13	57.58	55.86	7.24	7.39	7.32
$T_2 \times B_1$	94.53	99.16	96.85	90.49	94.27	92.38	6.85	6.88	6.87
$T_2 \times B_2$	48.05	51.79	49.92	43.97	47.49	45.73	6.51	6.72	6.61
$T_3 \times B_1$	99.50	104.33	101.92	95.33	99.20	97.27	7.03	7.33	7.18
$T_3 \times B_2$	52.90	58.27	55.59	47.55	51.41	49.49	6.78	7.02	6.90
$T_4 \times B_1$	113.37	118.20	115.78	109.23	113.68	111.46	8.05	8.14	8.09
$T_4 \times B_2$	61.57	65.07	63.32	57.55	61.30	59.42	7.77	7.98	7.88
$T_5 \times B_1$	115.23	121.21	118.22	111.17	116.21	113.69	8.16	8.42	8.29
$T_5 \times B_2$	67.95	71.61	69.78	63.93	67.47	65.70	7.92	8.22	8.07
$T_6 \times B_1$	112.20	117.91	115.11	108.34	112.78	110.57	7.64	7.68	7.66
$T_6 \times B_2$	59.92	63.54	61.73	55.95	60.44	58.19	7.40	7.77	7.59
$T_7 \times B_1$	95.73	101.15	98.44	91.37	95.38	93.38	6.96	7.01	6.98
$T_7 \times B_2$	50.97	57.31	54.14	46.70	49.86	48.28	6.65	7.00	6.83
$T_8 \times B_1$	106.71	112.14	109.42	104.23	108.06	106.15	7.35	7.44	7.40
$T_8 \times B_2$	53.27	59.35	56.31	48.87	52.38	50.62	7.17	7.38	7.27
$T_9 \times B_1$	113.47	119.48	116.47	109.30	115.16	112.23	8.08	8.32	8.20
$T_9 \times B_2$	66.07	69.59	67.83	62.00	65.37	63.69	7.87	7.99	7.93
$T_{10} \times B_1$	117.20	125.73	121.47	112.73	119.11	115.92	8.47	8.71	8.59
$T_{10} \times B_2$	71.03	74.95	72.99	54.75	70.37	68.59	8.36	8.26	8.31
$CD_{(0.05)}$	3.24	3.30	2.28	3.10	3.06	2.41	NS	NS	NS

Table 2: Effect of drip irrigation levels on vegetative parameters of alstroemeria (*Alstroemeria hybrida* L.)

Treatments	No. of shoots per plant			No. of leaves per plant		
	2014-15	**2015-16**	**Pooled**	**2014-15**	**2015-16**	**Pooled**
T_1	34.14	40.60	37.37	36.81	36.83	36.82
T_2	23.30	29.06	26.18	27.75	27.81	27.78
T_3	30.42	36.65	33.53	31.98	31.95	31.96
T_4	36.59	42.93	39.76	37.98	38.01	37.99
T_5	41.28	45.60	43.44	40.16	40.42	40.29
T_6	36.38	42.51	39.44	37.25	37.32	37.29
T_7	27.99	35.70	31.84	29.79	29.85	29.82
T_8	36.99	38.96	37.97	35.32	35.38	35.35
T_9	37.94	44.87	41.41	39.31	39.36	39.33
T_{10}	44.08	48.34	46.21	41.23	41.30	41.26
$CD_{(0.05)}$	2.55	5.72	3.08	0.81	0.91	0.60
Flushes						
1^{st} Flush (B_1)	47.31	54.42	50.87	42.72	42.75	42.74
2^{nd} Flush (B_2)	22.51	26.62	24.56	28.79	28.89	28.84
$CD_{(0.05)}$	1.14	2.56	1.38	0.36	0.41	0.27
Interactions						
$T_1 \times B_1$	45.80	54.59	50.52	43.90	43.92	43.91
$T_1 \times B_2$	22.47	26.61	24.54	29.72	29.74	29.73
$T_2 \times B_1$	35.20	41.28	38.24	33.86	33.94	33.90
$T_2 \times B_2$	11.40	16.83	14.12	21.64	21.68	21.67
$T_3 \times B_1$	43.19	50.08	46.64	40.17	40.10	40.13
$T_3 \times B_2$	17.64	23.22	20.43	23.78	23.81	23.79
$T_4 \times B_1$	48.91	57.89	53.40	45.05	45.06	45.06
$T_4 \times B_2$	24.26	27.96	26.11	30.91	30.95	30.93
$T_5 \times B_1$	55.54	61.92	58.73	46.67	46.71	46.69
$T_5 \times B_2$	27.01	29.27	28.14	33.64	34.13	33.89
$T_6 \times B_1$	47.98	55.58	51.78	44.16	44.15	44.16
$T_6 \times B_2$	24.77	29.44	27.11	30.34	30.49	30.42
$T_7 \times B_1$	40.14	46.88	43.51	37.12	37.17	37.14
$T_7 \times B_2$	15.84	24.51	20.18	22.47	22.52	22.49
$T_8 \times B_1$	46.68	52.45	49.57	42.67	42.74	42.71
$T_8 \times B_2$	27.29	25.46	26.38	27.96	28.01	27.99
$T_9 \times B_1$	50.66	59.23	54.95	45.90	45.95	45.92
$T_9 \times B_2$	25.22	30.51	27.87	32.71	32.77	32.74
$T_{10} \times B_1$	59.00	64.31	61.66	47.74	47.81	47.78
$T_{10} \times B_2$	29.15	32.36	30.76	34.71	34.78	34.75
$CD_{(0.05)}$	3.61	NS	NS	1.15	1.28	0.85

Table 3: Effect of drip irrigation levels on flowering parameters of alstroemeria (*Alstroemeria hybrida* L.)

Treatments	Number of flowers per stem			Number of flowers per cyme			Inflorescence diameter (cm)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
T_1	13.55	15.44	14.50	4.16	4.60	4.38	8.13	8.17	8.15
T_2	9.57	11.56	10.56	2.88	3.10	2.99	7.41	7.30	7.35
T_3	10.60	13.07	11.83	3.46	3.99	3.73	7.72	7.64	7.68
T_4	14.72	16.90	15.81	4.54	5.03	4.78	8.67	8.70	8.69
T_5	15.88	17.76	16.82	5.12	5.64	5.38	9.02	9.11	9.06
T_6	14.15	15.60	14.87	4.37	4.91	4.64	8.31	8.52	8.42
T_7	10.29	12.72	11.50	3.14	3.47	3.30	7.64	7.73	7.68
T_8	11.98	14.24	13.11	3.59	4.29	3.94	8.05	8.13	8.09
T_9	15.62	17.40	16.51	4.85	5.50	5.17	8.79	8.92	8.85
T_{10}	16.88	19.03	17.95	5.50	5.89	5.69	9.25	9.31	9.28
$CD_{(0.05)}$	1.55	1.46	1.05	0.52	0.41	0.33	0.29	0.32	0.21
Flushes									
1st Flush (B_1)	16.09	18.30	17.20	4.67	4.77	4.72	8.71	8.79	8.75
2nd Flush (B_2)	10.56	12.43	11.50	3.65	4.51	4.08	7.89	7.91	7.90
$CD_{(0.05)}$	0.69	0.65	0.47	0.23	0.18	0.15	0.13	0.14	0.09
Interactions									
$T_1 \times B_1$	16.57	18.89	17.73	4.58	4.61	4.59	8.75	8.81	8.78
$T_1 \times B_2$	10.54	11.99	11.27	3.74	4.59	4.17	7.51	7.53	7.52
$T_2 \times B_1$	11.30	13.40	12.35	3.08	3.11	3.10	7.46	7.37	7.42
$T_2 \times B_2$	7.83	9.71	8.77	2.67	3.09	2.88	7.35	7.22	7.29
$T_3 \times B_1$	12.27	14.91	13.59	3.99	4.01	4.00	7.99	7.81	7.89
$T_3 \times B_2$	8.93	11.22	10.08	2.94	3.98	3.46	7.46	7.47	7.46
$T_4 \times B_1$	18.20	20.34	19.27	5.05	5.13	5.09	9.17	9.21	9.19
$T_4 \times B_2$	11.24	13.45	12.35	4.03	4.92	4.48	8.17	8.19	8.18
$T_5 \times B_1$	19.27	21.20	20.23	5.78	5.87	5.82	9.46	9.46	9.46
$T_5 \times B_2$	12.50	14.31	13.41	4.47	5.41	4.94	8.59	8.75	8.67
$T_6 \times B_1$	17.20	19.15	18.17	4.90	4.97	4.93	8.81	9.22	9.02
$T_6 \times B_2$	11.10	12.04	11.57	3.83	4.84	4.34	7.81	7.83	7.82
$T_7 \times B_1$	12.02	14.62	13.32	3.57	3.60	3.58	7.87	8.03	7.95
$T_7 \times B_2$	8.57	10.81	9.69	2.70	3.33	3.02	7.41	7.42	7.42
$T_8 \times B_1$	14.37	16.86	15.62	4.10	4.33	4.22	8.60	8.77	8.69
$T_8 \times B_2$	9.60	11.62	10.61	3.07	4.25	3.66	7.49	7.50	7.49
$T_9 \times B_1$	18.97	20.77	19.87	5.43	5.71	5.57	9.23	9.47	9.35
$T_9 \times B_2$	12.27	14.03	13.15	4.27	5.28	4.77	8.35	8.37	8.36
$T_{10} \times B_1$	20.75	22.90	21.83	6.20	6.33	6.27	9.75	9.79	9.77
$T_{10} \times B_2$	13.00	15.16	14.08	4.80	5.44	5.12	8.74	8.82	8.78
$CD_{(0.05)}$	2.19	2.06	1.48	NS	NS	NS	0.41	0.45	0.30

Table 4: Effect of drip irrigation levels on flowering parameters of alstroemeria (*Alstroemeria hybrida* L.)

Treatments	Vase life (days)			Yield per plant (cut stems)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
T_1	15.70	15.75	15.72	28.92	34.40	31.66
T_2	13.62	13.86	13.74	18.21	22.70	20.45
T_3	14.51	14.53	14.52	24.73	29.83	27.28
T_4	17.37	17.41	17.39	32.09	37.65	34.87
T_5	19.38	19.82	19.60	37.52	41.45	39.48
T_6	16.36	16.53	16.44	31.35	36.64	34.00
T_7	14.13	14.24	14.19	22.39	27.07	24.73
T_8	14.84	15.00	14.92	28.42	32.46	30.44
T_9	18.52	19.11	18.82	33.88	40.06	36.97
T_{10}	20.05	20.51	20.28	41.19	45.17	43.18
$CD_{(0.05)}$	0.66	0.69	0.47	1.35	1.36	0.94
Flushes						
1st Flush (B_1)	17.14	17.24	17.19	40.75	46.84	43.80
2nd Flush (B_2)	15.75	16.10	15.93	18.99	22.64	20.81
$CD_{(0.05)}$	0.30	0.31	0.21	0.60	0.61	0.42
Interactions						
$T_1 \times B_1$	16.30	16.34	16.32	38.81	46.26	42.53
$T_1 \times B_2$	15.09	15.15	15.12	19.04	22.55	20.79
$T_2 \times B_1$	13.92	14.01	13.97	27.50	32.25	29.88
$T_2 \times B_2$	13.32	13.71	13.52	8.91	13.15	11.03
$T_3 \times B_1$	15.13	14.92	15.03	35.11	40.78	37.94
$T_3 \times B_2$	13.88	14.13	14.01	14.34	18.88	16.61
$T_4 \times B_1$	18.45	18.49	18.47	42.90	50.78	46.84
$T_4 \times B_2$	16.29	16.32	16.31	21.28	24.53	22.90

$T_5 \times B_1$	19.94	20.50	20.22	50.49	56.29	53.39
$T_5 \times B_2$	18.82	19.14	18.98	24.55	26.61	25.58
$T_6 \times B_1$	17.42	17.44	17.43	41.36	47.91	44.63
$T_6 \times B_2$	15.29	15.62	15.46	21.35	25.38	23.36
$T_7 \times B_1$	14.39	14.42	14.40	32.11	37.50	34.81
$T_7 \times B_2$	13.87	14.07	13.97	12.67	16.63	14.65
$T_8 \times B_1$	15.31	15.35	15.33	38.90	43.71	41.30
$T_8 \times B_2$	14.38	14.64	14.51	17.95	21.22	19.58
$T_9 \times B_1$	19.61	19.76	19.69	45.23	52.88	49.06
$T_9 \times B_2$	17.43	18.46	17.95	22.52	27.24	24.88
$T_{10} \times B_1$	20.95	21.22	21.09	55.14	60.10	57.62
$T_{10} \times B_2$	19.14	19.80	19.47	27.24	30.24	28.74
$CD_{(0.05)}$	0.93	0.98	0.67	1.91	1.92	1.33

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