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Effect of organic and inorganic manure on vegetative parameters of Alstroemeria under protected conditions

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Abstract
An experiment entitled response of Alstroemeria to organic and inorganic fertilizers under protected conditions was conducted with three levels of nitrogen viz, 150 ppm, 200 ppm and 250 ppm /15 days interval, phosphorus two levels viz 100 kg/ha and 150kg/ha while as three levels of organic manure viz., vermicompost 2.5 t/ha, FYM 5t/ha and sheep manure 5t/ha respectively. The results revealed that various levels of Nitrogen, Phosphorous and organic manure had a significant influence on vegetative parameters. Nitrogen at 150 ppm/15 days interval recorded minimum days (103.13) for rhizome sprouting. The influence of phosphorus on various vegetative parameters was significant at 150kg/ha recording minimum (104.41) days to sprouting while as among three levels of organic manure vermicompost recorded minimum (103.9) days to sprouting. The interaction between N_1P_1 at 150 ppm / 15 days interval and 100 kg p/ha recorded minimum (107.79) days to sprouting. Similarly the interaction between nitrogen and organic manure had a significant influence on days taken to sprouting with N_1O_1 taking minimum days of 98.80. The interaction effect of P_10_1 resulted in minimum number of days (103.07) to sprouting. However, the effect of Nitrogen, Phosphorus and organic manure and their interactions had a non-significant effect on other vegetative parameters.

Keywords: Nitrogen, phosphorus, vermi- compost, alstroemeria

Introduction
Alstroemeria belongs to family Alstroemeriaceae and is native to South America. It is an important cut flower and occupies global position within top ten cut flowers. In the Netherlands about 110 ha are under its cultivation and in the rest of the world Alstroemeria accounts for about 400 ha (Anonymous 2005) [5]. It is a perennial and rhizomatous plant. Though Alstroemeria can be grown in many places of the world yet there is a difference in its culture. Alstroemeria has a great potential as a cut flower. It is mainly cultivated in Netherlands, Columbia, United States and England (Bridgen, 1993) [3]. Being new crop to Indian atmosphere many private companies, farmers and farm cooperatives are importing its planting material from abroad. It is gaining popularity in Indian flower markets due to its long stem flowers, prolonged vase life and various colours and shades of petals, generally having lavender, maroon, white, orange, yellow, pink, red, and purple colours. In India it is of recent introduction. The crop was introduced in the year 2001 by ministry of agriculture, Govt. of India at three model Floriculture Centers, *viz*, Ooty (Tamil Nadu) Srinagar (J and K), and Chial (H,P). The crop requires relatively low temp for growth and development. The flowers are beautiful and have very long vase life.

Agro techniques for production of its cut flower and planting material (under polyhouse) have been standardized for Himachal Pradesh and other hill States; Generally Alstroemeria gives two flowering flushes from March to June, and September to November depending upon the crop cycle, planting time, and variety. Among the primary nutrients (Nitrogen, Phosphorous, and Potassium) are very important. They play important role in protein metabolism root growth, flowering, Fruiting etc. (Singh *et al*., 1991) [10].

Materials and Methods
An investigation entitled response of Alstroemeria to organic and inorganic fertilizers under protected conditions was carved out during 2009-2011 at Experimental field of the division of floriculture landscape Architecture SKUAST Kashmir. The day and night temperature during growth period were maintained between 18-22ºC and 12-16ºC respectively.

The soil was found to be silty clay loam in texture having good water holding capacity. The experiment comprised of factorial RBD with three replications and 18 treatment combinations. The crop was sown once and remained under observations for eighteen months. The soil was thoroughly prepared before planting of rhizomes by digging upto depth of 30 cm. Organic manures *viz* vermicompost, FYM and sheep manure were added to the well prepared beds. Phosphorous was applied as a basal dose before planting of rhizomes through single super Phosphate, while as Nitrogen application was done after planting of rhizomes at an interval of 15 days through the source of urea through fertigation. Rhizomes were divided and uniform and healthy rhizomes were selected. Single rhizome plantation was done and six rhizomes were planted per bed at a spacing of 30x45 cm. Shading was provided by using 50 percent shade nets during the period of high light intensity and temperature (May – July) to prevent plants from getting damaged due to scorching heat. Plants were staked with the sutli to the bamboo sticks inserted in the plots. Weeding and hoecing was done regularly after every fortnight.

Results and Discussion

Effect of Nitrogen

As evident from table – 1 nitrogen had a significant influence on the days taken to rhizome sprouting with nitrogen at 150 ppm per 15 days interval recording minimum days to sprouting i.e (103.13 days). However, no significant variation was observed in the percentage of establishment of plants. Also there was non-significant influence of various levels of nitrogen on number and weight of vegetative shoots removed at an interval of 45 days. Though nitrogen at 150 ppm/15 days interval recorded better results, Choudhary (2009) [4], reported that increasing levels of nitrogen significantly advanced the sprouting of tuberose bulbs Balashanmugan (1993) [2] observed that soaking of rhizomes in 0.2% KNO_3 recorded early sprouting in turmeric than untreated control. Similar results were obtained by Kumar *et al.* (2009) [8] after application of 110 gm of urea/m^2 in ratoon crop of dawana. Geetha and Nair (1990) [6] also reported significantly improved growth of coleus Parviflorus with the application of Nitrogen at 60 kg / ha. The non-significant influence of nitrogen on number and weight of vegetative stems could be due to the fact that almost uniform number of more branches were removed from the plant.

Effect of Phosphorus

Phosphorus had a significant influence in days to sprouting in Alstroemeria with a dose of 150 kg/ha taking minimum (104.41 days) to sprouting. Phosphorus however could not prove influential for percent established plants, number and weight of vegetative shoots removed at 45 days interval. Increased levels of phosphorus reduced number of days to rhizome sprouting in tuberose (Choudhary, 2009) [4].

Jaya Lakshmi (2003) [7] also found significant influence in growth of coleus with the application of increased phosphorus levels. Similar results were obtained by Veeraraghavathatham *et al*. (1988) [12] and Ravi (2004) [9] in coleus.

Effect of Organic Manure

Organic manure influenced Alstroemeria introducing the number of days to sprouting with vermicompost at 2.5t/ha recording minimum number of days to sprout rhizomes (103.59 days). However, no significant variation was observed in percent established plants and number and weight of vegetative shoots removed at 45 days interval. The findings in this study lends support from the findings of Shrivastava *et al.* (2006). They found FYM + vermicoonpost recorded maximum plant height and number of leaves in tuberose. Similarly, Gangadharan and Gopinath (2000) [5] found same results in gladiolus.

Effect of Interactions

The interaction effect of Nitrogen × phosphorus, Nitrogen × organic manure and phosphorus × organic manure had a significant influence in recording minimum days taken to sprouting i.e. 101.79, 98.80 and 103.07 at N_1P_1, N_1O_1 and P_1O_1 respectively. However, on percent established plants the influence of Nitrogen × Phosphorus, Nitrogen × Organic manure and Phosphorus × Organic manure interactions had non-significant influence.

The above interactions had non-significant influence on maximum dates in total number of vegetative stems removed at different intervals. However, Nitrogen × Phosphorus interactions on 30-10-2010 and 15-08-2011, Nitrogen× Organic manure interaction on 15-09-2010 had significant influence in recording maximum number of vegetative stems removed i.e (6.40) at N_2P_2 (7.62) at N_3P_2 and (7.99) at N_2O_3, respectively. Phosphorus × organic manure interaction had a non-significant influence on all dates. The interaction effect of Nitrogen ×phosphorus, Nitrogen× organic manure and phosphorus × organic manure had non-significant effect on maximum dates on weight (g) of vegetative stems removed at different intervals. However, Nitrogen × Phosphorus interaction on 01-04-2011 and 16-05-2011, Nitrogen × Organic manure interaction on 15-09-2010 and Phosphorus × Organic manure interaction on 01-04-2011 had a significant influence in recording maximum weight (g) of vegetative stems removed i.e. (70.49g) at N_1P_1, (65.31g) at N_2P_2, (73.57g) at N_3O_1 and (62.86g) at P_2O_2 respectively.

However, the combined interaction of Nitrogen × Phosphorus × organic manure had non-significant effect on all vegetative parameters except one date 01-04-2011 which proved to be significant recording (74.29g) maximum total weight of vegetative stems removed.

Table 1: Effect of nitrogen, phosphorus and organic manure on vegetative parameters of Alstroemeria

Treatments	Days taken to sprouting	% Established plants	Max No. of veg. stems removed at an interval of 45 days	Max. wt of veg. stems removed after an interval of 45 days
Nitrogen (ppm)				
150-N_1	103.13	74.99	7.40	66.17
200-N_2	106.35	71.29	7.07	60.02
250-N_3	106.95	72.21	6.71	54.74
CD (P=0.05)	2.19	NS	NS	NS
Phosphorus (kg/ha)				
100-P_1	106.54	71.60	6.86	61.65
150-P_2	104.41	74.07	7.26	58.96
CD(P=0.05)	1.79	NS	NS	NS

Organic Manure (tons/ha)				
Vermicompost-0_1	103.59	74.99	7.29	61.48
FYM-0_2	105.95	70.36	7.05	59.92
Sheep Manure-0_3	106.88	73.14	6.92	59.53
CD (P=0.05)	2.19	NS	NS	NS

Table 2: Effect of nitrogen × phosphorus, Nitrogen × organic manure and Phosphorus × organic manure interactions on vegetative parameters of Alstroemeria.

Treatments	Days taken to sprouting	% Established plants	Max No. of veg. stems removed at an interval of 45 days	Max. wt of veg. stems removed at an interval of 45 days.
Nitrogen × Phosphorus				
N_1P_1	101.79	72.21	7.47	64.82
N_1P_2	104.47	77.77	6.66	55.23
N_2P_1	108.93	72.22	7.29	65.13
N_2P_2	103.77	70.36	7.51	67.20
N_3P_1	108.91	70.36	5.81	55.02
N_3P_2	104.99	74.07	7.62	54.46
CD (P=0.05)	3.10	NS	1.37	NS
Nitrogen × Organic Manure				
N_10_1	98.80	69.44	7.71	65.39
N_10_2	103.70	83.33	7.05	56.43
N_10_3	106.88	72.22	6.44	58.25
N_20_1	105.47	80.55	7.33	68.30
N_20_2	107.25	61.10	7.44	65.82
N_20_3	106.32	72.22	7.44	64.38
N_30_1	106.51	74.99	6.60	50.75
N_30_2	106.87	66.66	6.66	57.51
N_30_3	107.46	74.99	6.88	55.95
CD (P=0.05)	3.80	NS	NS	NS
Phosphorus × Organic Manure				
P_10_1	103.07	75.92	6.59	62.94
P_10_2	107.95	66.66	6.84	59.90
P_10_3	108.60	72.22	7.14	62.12
P_20_1	104.11	74.07	7.84	60.03
P_20_2	103.95	74.07	7.25	59.94
P_20_3	105.17	74.07	6.70	56.93
CD (P=0.05)	3.10	NS	NS	NS

Table 3: Effect of Nitrogen x Phosphorus x Organic Manure on vegetative parameters of Alstroemeria

Treatments	Days taken to sprouting	% Established plants	Max No. of veg. stems removed at an interval of 45 days	Max. wt of veg. stems removed at an interval of 45 days
$N_1P_10_1$	95.08	72.21	8.55	71.40
$N_1P_10_2$	102.05	83.33	7.22	63.13
$N_1P_10_3$	108.22	61.11	6.66	59.92
$N_1P_20_1$	102.52	66.66	6.88	59.38
$N_1P_20_2$	105.35	83.33	6.88	49.72
$N_1P_20_3$	105.53	83.33	6.21	56.58
$N_2P_10_1$	107.83	88.33	6.11	61.27
$N_2P_10_2$	110.64	55.55	7.77	62.30
$N_2P_10_3$	108.33	77.77	7.99	71.83
$N_2P_20_1$	103.10	77.77	8.55	75.34
$N_2P_20_2$	103.92	66.66	7.10	69.35
$N_2P_20_3$	104.30	66.66	6.88	56.92
$N_3P_10_1$	106.30	72.21	5.10	56.15
$N_3P_10_2$	111.17	61.10	5.55	54.28
$N_3P_10_3$	109.25	77.77	6.77	54.62
$N_3P_20_1$	106.72	77.77	8.10	45.36
$N_3P_20_2$	102.58	72.22	7.77	60.74
$N_3P_20_3$	105.67	72.21	6.99	57.28
CD (P=0.05)	NS	NS	NS	NS

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