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Response of rhizomatic parameters of *Alstroemeria* to organic and inorganic fertilizers under protected conditions

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Abstract

A study entitled response of *Alstroemeria* to organic and inorganic fertilizers under protected conditions was conducted with three levels of nitrogen viz 150, 200 and 250 ppm. Phosphorus two levels viz 100 and 150 kg/ha, while as with three levels of organic manure viz. vermicompost 2.5 t/ha, FYM 5t/ha and sheep manure 5 t/ha respectively. The results revealed that nitrogen at 250 ppm/15 days interval obtained maximum weight of rhizomes (300.56 g), maximum number of rhizomes developed/planted rhizome (8.88) and maximum propagation coefficient (888.89) which was significantly superior over all other treatments. Phosphorus at 150 kg/ha recorded significantly highest number of rhizomes developed per planted rhizome (870.37). Vermicompost recorded significantly maximum number of rhizomes developed/ planted rhizome (331.11 g) and maximum propagation coefficient (961.11). The interaction effects between (N and P), (N and O), (P and O) and (N, P and O) were however non-significant.

Keywords: Alstroemeria, FYM, nitrogen, phosphorus, sheep manure, vermicompost

Introduction

Peruvian lily (*Alstroemeria* L.) belongs to family *Alstroemeraceae* and is a native to South America. It has about 93 species most of which exist in Chile followed by Brazil. *Alstroemeria* is an important cut flower and occupies global position within top ten cut flowers. Due to modern greenhouse cultivation technologies during last two decades, it has become a competitive greenhouse cut flower crop. In the Netherlands about 100 ha are under its cultivation and in the rest of the world Peruvian lily accounts for about 400 ha^[1]. The crop has a premium potential as a cut flower because it needs relatively low temperature for growth and development^[5] which is a valuable property in view of the steady using energy costs and secondly the plants bear the attractive flowers with wide range of colours and excellent keep-ability. The flowers are beautiful and have very long vase life. Generally *Alstroemeria* gives two flowering flushes from March-June, Sept.-Nov. depending upon the crop cycle, planting time and variety. Among the primary nutrients (N, P and K) are very important Nitrogen is a major structural part of the cell cytoplasm. It is an important constituent of aminoacids, proteins, purines and pyrimidines. Phosphorus is also essential constituent. It stimulates good growth, flowering and also helps in fruiting^[14].

Vermicomposting provides nutrient rich compost and is extremely helpful in organic waste management. An earthworm enhance humus production and thus improves physical health of soil and ensure granular or crumb soil structure with adequate soil aeration due to granular structure of their castings.

Since *Alstroemeria* is new crop, information on its nutritional requirement are scarce in particular with respect to quality characteristics under polyhouse conditions.

Hence the experiment was taken out at research farm, Division of Floriculture, and Landscape Architecture, SKUAST-Kashmir with the view to standardization of nutritional requirements for rhizomatic parameters of *Alstroemeria* under polyhouse conditions

Materials and Methods

The present investigation entitled response of *Alstroemeria* to organic and inorganic fertilizers under protected conditions was carried out during 2009-11 at the experimental field of Division of Floriculture, and Landscape Architecture sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Shalimar campus, Srinagar,

The experiment comprised of three levels of nitrogen viz. 150, 200 and 250ppm, two levels of phosphorus 100 and 150 kg/ha and three levels of organic manure viz. vermicompost (2.5 t/ha), FYM (5 t/ha) and sheep manure (5 t/ha).

Nitrogen application started after 15 days of planting of rhizomes through fertigation at an interval of 15 days. The source of nitrogen (urea) was mixed with irrigation water and then applied as fertigation. Phosphorus was applied as a basal dose before planting of rhizomes through single superphosphate at concentrations of 100 and 150 kg/ha.

Organic manures viz. vermicompost (2.5 t/ha), (FYM 5t/ha) and sheep manure 5t/ha were added to the well prepared beds as per the technical programme and mixed well before planting of rhizomes

Land was thoroughly prepared before planting of rhizomes. Rhizomes of *Alstroemeria* were selected, single rhizome plantation was done and six rhizomes were planted per bed at a spacing of 30×45 cm. The soil was analysed by the Division of Soil Science, SKUAST-Kashmir and was found to be slightly clay, warm in texture having good water holding capacity. The cultured operations started after complete field preparations. Watering was done immediately after planting and thereafter twice or thrice a week depending upon moisture content in the soil. Shading was provided by using 50% shade nets during the period of high light intensity and temperature to protect plants from getting damaged due to scorching heat. The statistical analysis was done to analyze the data by analysis of variance, using a factorial randomized block design [4].

Results and Discussion

Effect of nitrogen

Effect of nitrogen influenced significantly the total weight of rhizomes, number of rhizomes developed per planted rhizome and propagation coefficient. The highest levels of nitrogen at 250ppm/15 days interval produced maximum weight of rhizomes (300.56 g/plant) maximum number of rhizomes developed per planted rhizome (8.88) and maximum propagation coefficient (888.89). The improved results obtained in this study might be due to proper growth and development of the plants with increased levels of nitrogen that contributed to higher rhizome yield per plant. This lends support from findings of Thakur and Sharma and Singh. [18, 16] Dhar *et al* [2] obtained more bulb yield in tuberose at 200kg/ha with increased doses of nitrogen. Higher number of rhizomes and maximum rhizome weight was recorded with the application of 120 kg N in turmeric. Lal [7], Sheo [12] also reported increased number of rhizomes per plant with more diameter in turmeric at 60 kg /ha.

Effect of phosphorus

The analysed data in Table-1 showed that phosphorus had a significant influence on rhizome parameters in *Alstroemeria*. Phosphorus at 150 kg/ha recorded maximum weight of rhizomes (285.74 g/plant), highest number of rhizomes developed/planted rhizome (8.70). There all were found significantly superior over other treatments of phosphorus. The findings in this study gets support from the result of Hussain *et al* [6] who obtained highest yield of rhizomes in great galana with 80 kg of P₂O₅/ha. Singh and Neopaney [15] also obtained higher yield in ginger.

Muralidharan and Balakrishnan [9] observed that rhizome yield of turmeric was significantly improved by the application of 100 kg P₂O₅. Rao and Reddy [11] also obtained highest rhizome yield of 175 kg P₂O₅/ha in turmeric.

Effect of organic manure

Organic manures viz. vermicompost, FYM and sheep manure had a significant influence on rhizome parameters. It is evident from Table-1 that vermicompost at 2.5 t/ha recorded significantly maximum weight of rhizomes (331.11 g) maximum number of rhizomes developed per planted rhizome (9.61) and maximum propagation coefficient of 961.11.

The finding in this study lends support from the findings of Edward and Burrows [3] and have significantly increased surface area, providing more microstates for microbial decomposing organisms and strong adsorption and retention of moisture. [13]. Vermicompost also contains plant growth promoter and also represents an excellent soil conditioners due to its higher porosity, aeration, drainage, water holding capacity and microbial activity [17]. This might be the reason that findings in this study were significantly better with vermicompost than with other organic manures.

Rafiq *et al* [10] also reported that vermicompost amendments improved net yield of rhizome per plant. Higher crop yield of turmeric rhizomes was recorded when vermicompost at 2.5 t/ha was added [8].

Effect of interaction

The data pertaining to the number of rhizomes developed per planted rhizome, weight of rhizomes and propagation coefficient in *Alstroemeria* as influenced by the interaction between (nitrogen and phosphorus), (nitrogen and organic manure), (phosphorus and organic manure) and (nitrogen, phosphorus and organic manure) showed non- significant influences.

Table 1: Effect of nitrogen, phosphorus and organic manure on rhizome parameters of *Alstroemeria*.

Treatments	Weight of the rhizome cluster/plant (g)	No. of rhizomes developed per planted rhizome	Propagation coefficient
Nitrogen (ppm)			
150-N ₁	170.28	6.1111	611.11
200-N ₂	221.56	7.3333	733.33
250-N ₃	300.56	8.8889	888.89
CD (P=0.05)	53.881	1.018	1.018
Phosphorus (kg/ha)			
100-P ₁	175.85	6.1852	618.52
150-P ₂	285.74	8.7037	870.37
CD (P=0.05)	43.993	0.831	0.831
Organic manure (t/ha)			
Vermicompost-O ₁	331.11	9.6111	961.11
FYM-O ₂	161.67	5.7778	577.78
Sheep Manure-O ₃	199.61	6.9444	694.4
CD (P=0.05)	53.881	1.018	1.018

Table 2: Effect of (nitrogen x phosphorus), (nitrogen x organic manure) and (phosphorus x organic manure) interaction on the rhizome parameters of *Alstroemeria*

Treatments	Weight of the rhizome cluster/plant (g)	No. of rhizomes developed per planted rhizome	Propagation coefficient
Nitrogen x phosphorus			
N ₁ P ₁	136.89	4.889	488.90
N ₁ P ₂	203.89	7.333	733.30
N ₂ P ₁	179.22	6.222	622.20
N ₂ P ₂	263.89	8.444	844.40
N ₃ P ₁	211.67	7.444	744.40
N ₃ P ₂	389.44	10.333	1033.30
CD (P=0.05)	NS	NS	NS
Phosphorus (kg/ha)			
N ₁ O ₁	268.33	8.500	850.00
N ₁ O ₂	100.83	4.333	433.30
N ₁ O ₃	141.67	5.500	550.00
N ₂ O ₁	352.00	9.500	950.00
N ₂ O ₂	148.33	5.333	533.30
N ₂ O ₃	191.33	7.167	716.70
N ₃ O ₁	400.00	10.833	1033.30
N ₃ O ₂	235.83	7.667	766.70
N ₃ O ₃	265.83	8.167	816.70
CD (P=0.05)	NS	NS	NS
Organic manure (t/ha)			
P ₁ O ₁	249.44	8.222	822.20
P ₁ O ₂	122.22	4.667	466.70
P ₁ O ₃	155.89	5.667	566.70
P ₂ O ₁	412.78	11.000	1100.00
P ₂ O ₂	201.11	6.889	688.90
P ₂ O ₃	243.33	8.222	822.00
CD (P=0.05)	NS	NS	NS

NS =Non- Significant

Table 3: Effect of (Nitrogen x Phosphorus x organic manure), interaction on the rhizome parameters of *Alstroemeria*.

Treatments	Weight of the rhizome cluster/plant (g)	Number of rhizomes developed per planted rhizome	Propagation coefficient
N ₁ P ₁ O ₁	203.33	7.000	700.00
N ₁ P ₁ O ₂	85.00	3.333	333.30
N ₁ P ₁ O ₃	121.67	4.333	433.30
N ₁ P ₂ O ₁	333.333	10.000	1000.00
N ₁ P ₂ O ₂	116.67	5.333	533.00
N ₁ P ₂ O ₃	161.67	6.667	666.70
N ₂ P ₁ O ₁	263.33	8.333	833.30
N ₂ P ₁ O ₂	118.33	4.333	433.30
N ₂ P ₁ O ₃	156.00	6.000	600.00
N ₂ P ₂ O ₁	386.67	10.667	1066.70
N ₂ P ₂ O ₂	178.33	6.333	633.30
N ₂ P ₂ O ₃	226.67	8.333	833.30
N ₃ P ₁ O ₁	281.67	9.333	933.30
N ₃ P ₁ O ₂	163.33	6.333	633.30
N ₃ P ₁ O ₃	190.00	6.667	666.70
N ₃ P ₂ O ₁	518.33	12.333	1233.30
N ₃ P ₂ O ₂	308.33	9.000	900.00
N ₃ P ₂ O ₃	341.67	9.667	966.70
CD (P=0.05)	NS	NS	NS

Conclusion

Among the levels of inorganic and organic nutritional requirements, nitrogen at 250 ppm/15 days interval, phosphorus at 150 kg/ha and vermicompost at 2.5t/ha were found best nutritional levels for rhizomatic parameters of *Alstroemeria* under poly house conditions. The treatment combination of nitrogen at 250ppm /15 days interval, phosphorus at 150kg/ha and vermicompost at 2.5t/ha(N₃P₂O₁) produced highest benefit –cost ratio and net returns.

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