Original Research Article

Evaluation of carnation cultivars; and nitrogen and Indole Acetic Acid for their growth, yield and quality in Khumaltar, Nepal

ABSTRACT

Carnation is an important cut flower in Nepal. Several cultivars imported from abroad are being adopted for their commercial production. However, the performance of these cultivars in the specific agro-climate has not yet determined. Thus, study aimed to evaluate the performance of common cultivars, including mineral nutrition and IAA hormone on the plant growth and flowering. The study was carried out in Horticulture Research Division, Khumaltar, Nepal during 2012 and 2013. Four cultivars: King Lion, Delson, Eskimo and White Liberty including nitrogen and foliar application of IAA were evaluated for plant growth and floral characteristics. The experiment was held in randomized complete block design (RCBD) with four replications. Based on the results, cultivar King Lion had significantly highest plant height (20.66 cm), while cultivar Eskimo had the highest flower stem length (53.59 cm) and stem diameter (5.63 cm) followed by Delson (51.66 cm). The lower flower stems lengths of cultivars: White Liberty (42.48 cm) and King Lion (43.87 cm) were at par. The effect of mineral nutrition and hormone on plant height, flower stem length and flower head diameter was non-significant, however, IAA 25 ppm foliar spray was found superior over N 40 g/m2 and IAA 50 ppm applications. Thus, Eskimo is recommended as the excellent cultivar for its bigger flower stem, straightness and attractive flower looking, while cultivars; Delson and White Liberty as promising for higher flower yield. Similarly, soil application of nitrogen @ 40 g/m2 and foliar spray of auxin @ 25 ppm are recommended for higher flower yield.

Key words: Carnation; mineral nutrition; cultivar; growth; flower

1. INTRODUCTION

Carnation (*Dianthus caryophyllus* L.) as a cut flower occupies an important place in the worlds' floriculture trade [7, 6, 15, 20]. It has been considered an important cut flower due to its excellent keeping quality, wide array of color and forms [2, 10, 11, 12]. In Nepal, it has been emerging as the most potential enterprise for the income in the urban areas, especially capital city, Kathmandu [9]. Of various cut flowers, carnation stands 3rd position, having a huge potential to fetch increased domestic demand as well as export market opportunity [5, 6, 7, 16].

In Nepal, this cut flower is at very beginning for its commercial production that is mostly confined to summer season production, and very little during winter season [5]. Currently, about one dozen of carnation cultivars as imported from Spain and Holland have been cultivated in Nepal [5]. The cultivars with diverse flower colors and forms with better fragrance and longer vase life are in high demand by the consumer [12]. Thus, selection for high yielding cultivars with quality attributes is very crucial [17]. Likewise, the flower requires balanced mineral nutrition for better growth and quality production and foliar application of nutrition is also beneficial [1, 18, 4].

However, little works have been carried out regarding cultivars and agronomy on the specific conditions of Nepal so far [7, 5, 6, 14]. Likewise, there has not been recommended dose of mineral nutrition and hormone for the carnation in the existing cultivation practice in Nepal [3, 5].

Therefore, this study aimed to evaluate testing the available cultivars for the suitability and adaptability with respect to flowering, flower quality, and yield parameters in the specific climate of Kathmandu valley, Nepal. In addition, effect of mineral nutrition including hormone application on the growth and flowering were also evaluated.

2. MATERIALS AND METHOD

The experiment was conducted at Horticulture Research Division, Khumaltar during two successive seasons from April 2012 to July 2013. Four cultivars viz., King Lion, Delson, White Liberty and Eskimo; and four different mineral nutrition and hormones; viz.; Nitrogen @ 40 g/m^2, Indole Acetic Acid (IAA)

@ 25 ppm, IAA @ 50 ppm, and control; were evaluated under 4 x 4 factorial randomized block designs with four replications. The rooted tissue-cultured plants of each cultivar were transplanted on 20th April, 2012 under plastic tunnel (semi-open condition). The experimental plot was maintained at 1.2 m^2 accommodating 24 plants at the spacing of 20 cm plant to plant and 25 cm row to row distance. The nitrogen and IAA were applied six times at 15 days interval from first bud formation onward, while Urea for nitrogen was top dressed in the soil and IAA diluted solution was foliar sprayed. The other intercultural operations such as pinching, plant supporting, disbudding, irrigation and plant protection measures were carried out as per recommendation. The observation on the vegetative growth viz. plant height; flower stem length, flower stem diameter and flower head diameter were measured from the sample plants during mid-harvesting period. The measurement was carried out with digital vernier caliper and by conventional method and the data were statistically analyzed with the statistical software ADEL-R 3.2.0.

3. RESULTS AND DISCUSSION

3.1 Plant survival (%)

Plant survival percentage of carnation cultivars against transplanting sock and disease during initial stage of plant establishment is shown in Figure 1. Plant survival percentage was found significantly different between cultivars. It was at par between cultivar King Lion (94.9%), White Liberty (94.1%) and Eskimo (89.1%), whereas cultivar Delson had significantly lowest plant survival (76.2%) compared to other cultivars.

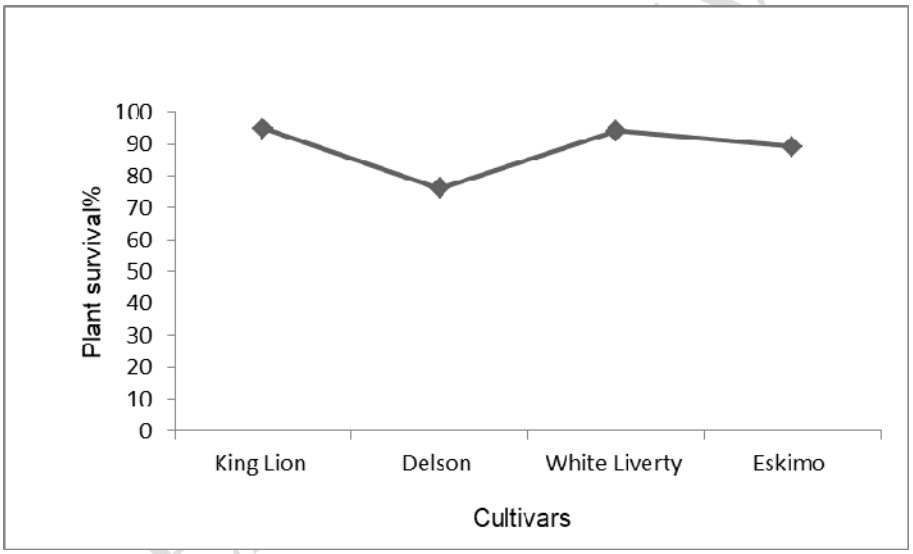

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Figure 1: Plant survival % after transplanting

3.2 Vegetative and floral characteristics

Vegetative and floral characteristics in response of carnation cultivars and mineral nutrition and hormone are presented in Table 01. The result revealed that the cultivar King Lion had significantly highest plant height (20.66 cm) than other three cultivars. The effect of mineral nutrition and hormone on plant height was found non-significant different. However, effect of IAA 25 ppm foliar spray was resulted at highest plant height compared to other nutrients. Mehmood [13] observed a contrast result as plant heights were ranged from 64.96 to 78.66 cm among the different cultivars.

Similarly, variation of flower stem length due to cultivars was found significant (P≤.001). Whist cultivar Eskimo had highest flower stem length (53.59 cm) followed by Delson (51.66 cm). The lower flower stems lengths of cultivars: White Liberty (42.48 cm) and King Lion (43.87 cm) were at par. The effect of mineral nutrition and hormone on flower stem length was also non-significant. However, the effect of nitrogen had greater on the flower stem diameter as compared to IAA application.

The result of flower stem diameter in response of cultivars was found significantly different (P≤.001) but it was found non-significant due to the effect of mineral nutrition and hormones. Significantly,

highest flower stem diameter (5.63 mm) was observed at cultivar Eskimo, where as it was found at par between cultivars: King Lion (4.99 mm), Delson (5.11 mm) and White Liberty (4.91 mm). Mehmood et al. [13] found similar result as cultivar Nelson had 6.21 mm flower stem diameter, while King Lion had 3.63 mm.

In contrary, flower head diameter in response of cultivars and mineral nutrition and hormone was found non-significant. However, cultivar White Liberty had the highest flower head (6.81 cm) followed by King Lion (6.77 cm), while the largest flower head was observed at IAA 50 ppm spray (6.88 cm) followed by N 40 g/m^2 (6.84 cm). Singh et al. [18] found the maximum flower diameter (7.83 cm) with Red King.

Table 01: Vegetative and floral characteristics in response of cultivars; and mineral nutrition and hormone evaluated at HRD, Khumaltar during 2012-2013.

Treatments	Plant height (cm)	Flower stem length (cm)	Flower stem diameter (mm)	Flower head diameter (cm)
Cultivars				
King Lion	20.66 a	43.87 b	4.99 b	6.77
Delson	16.38 b	51.66 a	5.11 b	6.64
White Liberty	17.55 b	42.48 b	4.91 b	6.81
Eskimo	17.78 b	53.59 a	5.63 a	6.59
P value	***	***	***	Ns
LSD (0.05)	1.324	3.860	0.202	0.48
CV %	10.3	11.3	5.5	10.1
Mineral nutrition and hormone				
Control	17.92	48.36	5.09	6.61
N 40 g/m^2	17.68	47.65	5.37	6.84
IAA 25 ppm	18.47	48.59	5.12	6.48
IAA 50 ppm	18.31	47.02	5.07	6.88
P value	ns	Ns	**	ns
LSD (0.05)	1.324	3.860	0.202	0.48
CV %	10.3	11.3	5.5	10.1

*Note: ** & *** indicate statistically highly significant difference respectively at P≤0.01 and ≤0.001 levels; and ns indicates non-significant difference. Data were average of two consecutive years: 2012 and 2013.*

3.3 Yield and yield characteristic

The response of carnation cultivars on flower yield and yield characteristics is presented in Table 02. The result of days to first flowering revealed highly significant (P≤.001) different due to cultivars, but the result was non-significant due to nutrient. Cultivar Eskimo were significantly earlier (180 days) than cultivars: King Lion (198 days), Delson (198 days) and White Liberty (196 days). In contrary, effect of mineral nutrition and hormone on maturity days was found non-significant. However, effect of N 40

g/m^2 and IAA 50 ppm were earlier compared to others (Table 02). The result of flower number per plant was found non-significantly different due to both cultivars and nutrient effects. The highest flower number per plant was recorded at cv. King Lion (5.06 nos/plant) followed by cv. White Liberty (5.03 nos/plant) compared to other cultivars, while the highest flower number was recorded at IAA 50 ppm spray (5.02 nos/plant). Similar findings were observed by Mehmood et al. [5] as the highest number of flowers was recorded in Tempo (6.4 nos/plant) followed by Nelson (6.3 nos/plant). Cultivar Kaly (2.66 nos/plant) produced minimum number of flowers per plant. Similar finding was observed by Singh et al. [18] that the highest number of flowers was recorded at cultivar Red King (5.6 nos/plant), while minimum flowers was observed with Tuareg (4.2 nos/plant).

Flower yield was found highly significantly (P≤.001) different among cultivars and mineral nutrition and hormone. The highest flower yield was found at cv. King Lion (144 nos/m2) followed by cv White Liberty (138 nos/m^2). Cultivar Delson gave significantly the lowest yield (79 nos/m^2). Likewise, effect of mineral nutrition and hormone on flower yield was found significantly (P=0.001) different. Nitrogen top dress @ 40 g/m^2 at two times gave highest yield (121 nos/m^2) followed by IAA @ 500 ppm foliar spray two times (112 nos/m^2).

Table 02. Yield and yield characteristic of carnation cultivars evaluated at HRD, Khumaltar during 2012-2013.

Treatments	Days to first flower harvest	No of Flower /plant	Yield (nos) /m^2
Cultivars			
King Lion	198 a	5.06	144 a
Delson	198 a	4.41	79 c
White Liberty	180 b	5.03	138 a
Eskimo	196 a	4.58	92 b
P value	***	ns	***
LSD (0.05)	7.43	0.392	5.85
CV %	13.3	11.6	7.3
Mineral nutrition and hormone			
Control	195	4.47	110
N 40 g/m^2	191	4.83	121
IAA 25 ppm	194	5.02	112
IAA 50 ppm	191	4.77	110
P value	ns	ns	**
LSD (0.05)	7.43	0.292	5.85
CV %	13.3	11.6	7.3

*Note: *, ** & *** indicate statistically significant difference respectively at P ≤0.05, ≤0.01 & ≤0.001 levels and ns indicates non-significant difference. Data were average of two consecutive years: 2012 and 2013.*

4. CONCLUSION

Based on the overall performance, cultivar Eskimo found the best followed by King Lion and White Liberty. The cultivar Eskimo is excellent for its bigger flower stem, straightness and attractive flower looking. Similarly, cultivars; Delson and White Liberty gave better flower yield. As far as nutrient is concerned, effect of nitrogen and IAA on flower yield was not found prominent. Definitely, carnation needs nitrogen more in split doses during whole crop period. Therefore, such experiment should be conducted in control management. However, effect of nitrogen @ 40 g/m2 and foliar spray of IAA @ 25 ppm was positive.

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