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Comparative evaluation of carnation (*Dianthus caryophyllus* L.) genotypes under organic and inorganic fertilization modules

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Abstract
The study was carried out at Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during 2020-2021 under polyhouse condition. The experiment comprised of fourteen genotypes of carnation and two treatments: inorganic fertilization module (Recommended Dose of Fertilizers) and organic fertilization module (Jeevamrit @ 20 ml/plant as drenching at 30 days interval). The experiment was laid out in Randomized Block Design (Factorial) with three replications. The results revealed that among the different genotypes of carnations studied the genotype 'Bizet' performed best in terms of plant height (96.38 cm), stem length (81.40 cm), stem sturdiness (6.17º) and number of flowers per square metre (116.00) while stem thickness was maximum in 'UHFSCar-1' (5.95 mm) and 'PM-2' (113.83) recorded the least number of days taken for bud formation. The organic fertilization module performed relatively well which suggests that organic fertilization module (jeevamrit @ 20 ml/plant as drenching at 30 days interval) can act as an alternative for chemical fertilizers in consideration to the improvement in soil health and have the potential to contribute to better financial outcomes.

Keywords: Carnation, *Dianthus caryophyllus*, vegetative growth, organic nutrient, jeevamrit, fertigation

Introduction
Carnation (*Dianthus caryophyllus* L.) is highly valued in global trade as a member of the Caryophyllaceae family, with a diploid chromosome of 2n=30. It is renowned for its wide range of colors, exceptional longevity and ability to withstand long-distance transportation. There are two main types: the standard carnation, which typically features a single flower per stem and is favored in the cut flower industry and the spray carnation, known for having multiple flowers per stem.

The cut flower industry's rapid growth has led to widespread use of chemical fertilizers, insecticides, fungicides and growth promoters, causing concerns due to rising costs, limited availability and environmental impact on soil and water quality. To address these issues, promoting tested alternatives and eco-friendly products among farmers is essential to reduce reliance on chemicals and promote sustainable flower farming practices.

Natural Farming is being adopted which utilizes liquid formulation like jeevamrit- a fermented product made of cow products namely dung and urine and other ingredients like gram flour and jaggery which are used as plant growth enhancing substances prepared with material available with farmers. Jeevamrit promotes immense biological activity in soil and makes the nutrients available to crop (Devakumar *et al*., 2008) [4]. Jeevamrit contains huge amount of microbial population which multiply and act as a stimulant for improving soil health, intensify microbial activities in soil and ultimately ensures higher availability and uptake of nutrients by the crops (Palekar, 2006) [12]. It is considered to be a rich source of beneficial micro flora which support, stimulate the plant growth, enhances the biological efficiency of crops and help in getting better vegetative growth and also good quality yield. Keeping in view the importance and popularity of carnation and lack of database regarding organic cultivation of this crop, the present study was taken up.

Materials and Methods

The study was laid out in the experimental farm of Department of Floriculture and Landscape Architecture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (2020-2021). The experiment was laid out a Randomized Block Design (Factorial) and replicated thrice. Factor-I comprised of fourteen genotypes i.e., fourteen genotypes viz., PM-1, PM-2, PM-3, UHFSCar-1, UHFSCar-2, UHFSCar-3, UHFSCar-4, UHFSCar-5, UHFSCar-6, UHFSCar-7, UHFSCar-11, Bizet, Tempo and Raggio-de-Sole and factor-II comprised of the fertilization modules which were inorganic nutrient (Recommended dose of fertilizer) [10-10-10 g/m^2 NPK (as basal) + 100 ppm N + 140 ppm K (as fertigation- twice a week)] and organic nutrient (Jeevamrit @ 20 ml/plant to be applied as drenching at 30 days intervals). The basal doze of chemical fertilizer was mixed with the growing media. 10-10-10 g/m^2 NPK was met through urea- 22g/m^2, SSP- 62.5g/m^{2}and MOP-16.6g/m^2. Fertigation was started after 30 days of planting when the plants were established in the growing medium by applying 150 to 250 ml depending upon the age of the plant in the root zone of the plant manually. Different fertilizers like; multi-K (13-0-45), calcium nitrate (commercial grade) and urea were used as a source of nitrogen and potassium. To supply 100 ppm of nitrogen, 60 ppm was applied as nitrate N [potassium nitrate (multi K)- 40 ppm and $Ca(NO_3)_2$ - 20 ppm] by dissolving 311 mg of multi K and 129 mg of $Ca(NO_3)_2$ in 1 litre of water. Remaining 40 ppm N was supplied as ammonical form through urea by dissolving 87 mg in 1 litre of water. For the supply of K_2O, the entire quantity is met through the application of multi-K. Jeevamrit was prepared by mixing cow dung- 1 kg, cow urine- 1 litre, jaggery- 200 gm, pulse flour- 200 gm and a handful soil and water was added to make up to a volume of 20 litres then let it ferment for four days. On the fifth day, drenching was done at a rate of 20 ml/plant. Drenching of jeevamrit was started at 30 days after transplanting at 1:4 dilutions.

The rooted cuttings were transplanted on 10th December 2020 in a raised bed of 1.20 m x 0.8 m with spacing of 20 cm x 20 cm in the polyhouse, thus accommodating 24 plants/plot. Well rotten Farm Yard Manure @ 5 kg/m^2 was mixed thoroughly at the time of bed preparation and vermicompost @ 1 kg/m^2 was applied at the time of planting. Standard single pinching was done at 45 days after planting.

The data were analyzed by simple statistical methods for interpretation of the data using the procedures described by Gomez and Gomez (1984) [7]. The analytical error of individual samples was generally below 5%.

Results and Discussion

Plant height was recorded at the time of peak flowering stage (Table 1). Significant differences in plant height were observed among different genotypes and fertilization modules. Among different genotypes, maximum plant height was observed in genotype ‘Bizet’ (96.38 cm) which was statistically at par with genotype ‘PM-3’ (95.65 cm) while it was minimum in genotype ‘UHFSCar-4’ (72.03 cm). The organic fertilization module (82.86 cm) attained higher plant height as compared to inorganic fertilization module (82.76 cm). However, it was found to be non-significant. Stem length is an important attribute of grading in carnation, maximum stem length among the genotypes was obtained in genotype ‘PM-3’ (81.90 cm) which was statistically at par with genotype ‘Bizet’ (81.40 cm) while genotype ‘UHFSCar-4’ (63.32 cm) recorded minimum stem length among the genotypes which was at par with genotypes ‘UHFSCar-1’ (64.93 cm) and ‘UHFSCar-7’ (63.50 cm). Between the two fertilization modules, inorganic fertilization module (72.55 cm) recorded greater stem length over organic fertilization module (70.78 cm). However, the fertilization modules for stem length was found to be no significant. As the stem length of all the genotypes were found to be above 55 cm, all the genotypes under study fell under ‘A’ grade. The plant height and stem length varied significantly due to the difference in the genetic makeup of the genotypes and their interaction with climate particularly temperature which was variable during different months. The results are in agreement with the findings of Gharge *et al.* (2011) [6], Verma *et al.* (2012) [17] Mehmood *et al.* (2014) [10], Nacho (2016) [11], Chauhan *et al.* (2017) [2] and Sharma (2020) [15] in carnation.

Table 1: Effect on vegetative parameters of carnation with respect to different genotypes and fertilization modules

Genotypes	Plant height (cm)			Stem length (cm)			Stem thickness (mm)		
	Inorganic fertilization module	Organic fertilization module	Mean	Inorganic fertilization module	Organic fertilization module	Mean	Inorganic fertilization module	Organic fertilization module	Mean
PM-1	86.27	86.60	86.43	77.20	74.13	75.67	5.33	5.76	5.55
PM-2	86.27	91.69	88.98	75.73	77.80	76.77	5.03	5.66	5.35
PM-3	97.53	93.76	95.65	83.73	80.07	81.90	5.37	5.48	5.42
UHFSCar-1	78.27	76.73	77.50	65.73	64.13	64.93	5.95	5.96	5.95
UHFSCar-2	81.33	79.74	80.54	72.87	67.60	70.23	5.83	5.83	5.83
UHFSCar-3	79.73	81.20	80.47	70.60	73.93	72.27	5.73	5.81	5.77
UHFSCar-4	73.80	70.27	72.03	65.23	61.40	63.32	5.81	5.66	5.73
UHFSCar-5	82.33	83.06	82.70	72.47	71.00	71.73	5.87	5.91	5.89
UHFSCar-6	80.27	81.43	80.85	73.73	69.73	71.73	5.44	5.89	5.67
UHFSCar-7	77.20	76.54	76.87	64.00	63.00	63.50	5.66	5.89	5.78
UHFSCar-11	78.73	80.68	79.71	69.80	70.00	69.90	5.01	5.17	5.09
Bizet	96.07	96.70	96.38	84.93	77.87	81.40	5.90	5.92	5.91
Tempo	82.60	83.24	82.92	70.87	69.53	70.20	5.70	5.84	5.77
Raggio-de-Sole	78.20	78.40	78.30	68.80	70.67	69.73	5.52	5.90	5.71
Mean	82.76	82.86	82.81	72.55	70.78	71.67	5.58	5.76	5.67
$CD_{0.05}$	Genotypes		3.67			4.68			0.40
	Fertilization modules		NS			NS			NS
	Genotypes x Fertilization modules		NS			NS			NS

Maximum stem thickness was obtained in genotypes 'UHFSCar-1' (5.95 mm) which was found to be statistically at par with genotypes 'PM-1' (5.55 mm), 'UHFSCar-2' (5.83 mm), 'UHFSCar-3' (5.77 mm), 'UHFSCar-4' (5.73 mm), 'UHFSCar-5' (5.89 mm), 'UHFSCar-6' (5.67 mm), 'UHFSCar-7' (5.78 mm), 'Bizet' (5.91 mm), 'Tempo' (5.77 mm) and 'Raggio-de-Sole' (5.71 mm). In contrast, minimum stem thickness was recorded in genotype 'UHFSCar-11' (5.09 mm) which was found to be at par with genotypes 'PM-2' (5.35 mm) and 'PM-3' (5.42 mm). The fertilization modules for stem thickness was found to be non-significant. The variations in the stem thickness could be attributed to the different genetic composition of the genotypes which was supported by the works done in carnations by Dilta and Gupta (2010) [5], Karthikeyan *et al.* (2013) [8], Sharma (2020) [15] and Anand *et al.* (2021) [1].

Stem sturdiness was measured as the angle of deviation from the horizontal plane (Table 2). The sturdiest stem in general was noticed in case of 'Bizet' (6.17°). Other genotypes producing similar type of sturdier stem was 'UHFSCar-3' with 7.17° deviation from the horizontal plane. As all the genotypes recorded deviation less than 15°, all the genotypes were classified as 'A' grade.

Genotype 'PM-2' (113.83 days) took minimum days for bud formation whereas genotype 'UHFSCar- 6' (150.67 days) took maximum days for bud formation which was found to be statistically at par with genotypes 'UHFSCar- 1' (148.00 days), 'UHFSCar- 2' (146.50 days), 'UHFSCar- 3' (148.17 days), 'UHFSCar- 4' (142.33 days), 'UHFSCar- 7' (140.00 days), 'UHFSCar- 11' (146.47 days) and 'Tempo' (142.17 days). The organic fertilization module (135.45 days) took lesser number of days for bud formation as compared to inorganic fertilization module (140.02 days). The variations in the number of days taken for bud formation might be due to the difference in the genetic makeup of the genotypes. The results were supported by the findings of Roni *et al.* (2014) [14], Chauhan *et al.* (2017) [2] and Medeo *et al.* (2019) [9]. Organic feritilization module performed better which could be due to the constituents of jeevamrit which contain both essential macro and micro nutrients, essential amino acids, many vitamins, growth promoting substances like Gibberllic Acid (GA_3), Indole Acetic Acid (IAA) and beneficial microorganisms and increased synthesis of photosynthates, which is responsible for the growth of plants and might have helped in bud formation. These results are supported by the findings of Pamya (2018) [13] in gerbera, Choudhary *et al.* (2021) [3] in marigold and Thakur *et al.* (2023) [16] in iris. Genotype 'Bizet' (116.00) recorded maximum number of flowers per square metre which was found to be at par with 'Tempo' (110.40) and 'Raggio-de-Sole' (112.80) whereas minimum number of flowers per square metre was recorded in genotype 'UHFSCar-7' (96.80) which was statistically at par with genotypes 'PM-1' (98.40), 'PM-2' (101.60), 'PM-3' (100.00), 'UHFSCar-1'(101.88), 'UHFSCar-2' (102.40), 'UHFSCar-3' (97.60), 'UHFSCar-4' (102.40), 'UHFSCar-6' (99.20) and 'UHFSCar-11' (98.40). The fertilization modules were found to be non-significant; however, organic fertilization module (104.00) recorded a greater number of flowers per square metre as compared to inorganic fertilization module (102.33).

Table 2: Effect on stem sturdiness, number of days taken for bud formation and number of flowers per square metre of carnation with respect to different genotypes and fertilization modules

Genotypes	Stem sturdiness (°)			Number of days taken for bud formation			Number of flowers per square metre		
	Inorganic fertilization module	Organic fertilization module	Mean	Inorganic fertilization module	Organic fertilization module	Mean	Inorganic fertilization module	Organic fertilization module	Mean
PM-1	10.00	8.53	9.27	128.00	130.33	129.17	97.60	99.20	98.40
PM-2	10.00	10.87	10.43	114.67	113.00	113.83	100.80	102.40	101.60
PM-3	9.00	9.67	9.33	127.00	133.33	130.17	97.60	102.40	100.00
UHFSCar-1	9.93	10.73	10.33	156.00	140.00	148.00	101.36	102.40	101.88
UHFSCar-2	10.00	9.00	9.50	144.00	149.00	146.50	104.00	100.80	102.40
UHFSCar-3	9.20	5.13	7.17	156.33	140.00	148.17	97.60	97.60	97.60
UHFSCar-4	9.67	7.00	8.33	146.33	138.33	142.33	100.80	104.00	102.40
UHFSCar-5	8.47	8.33	8.40	140.67	129.67	135.17	107.20	105.60	106.40
UHFSCar-6	7.67	9.20	8.43	150.33	151.00	150.67	97.60	100.80	99.20
UHFSCar-7	10.40	9.67	10.03	146.00	134.00	140.00	96.00	97.60	96.80
UHFSCar-11	10.20	8.67	9.43	148.00	145.33	146.67	96.00	100.80	98.40
Bizet	5.07	7.27	6.17	129.00	130.67	129.83	113.60	118.40	116.00
Tempo	9.60	9.40	9.50	141.33	143.00	142.17	110.40	110.40	110.40
Raggio-de-Sole	8.87	8.47	8.67	132.67	118.67	125.67	112.00	113.60	112.80
Mean	9.15	8.71	8.93	140.02	135.45	137.74	102.33	104.00	103.17
$CD_{0.05}$	Genotypes		2.06			11.49			10.34
	Fertilization modules		NS			4.35			NS
	Genotypes x Fertilization modules		NS			NS			NS

The study indicated that the genotype 'Bizet' was the best in terms of quality parameters and that carnations performed well in both the fertilization modules however, the organic fertilization module performed relatively better. This suggests that organic fertilization module (Jeevamrit @ 20 ml/plant as drenching at 30 days interval) can act as an alternative for chemical fertilizers in consideration to improving soil health and have the potential to contribute to better financial outcomes.

References

1. Anand M, Kamalkumaran PR, Velmurugan M, Sankari A. Performance of carnation (*Dianthus caryophyllus* L.)

varieties under protected condition. International Journal of Plant & Soil Science. 2021;33(9):13-19.
2. Chauhan P, Dhiman SR, Gupta YC, Kashyap B, Gupta RK, Dogra RK. Evaluation and variability studies in carnation genotypes. Journal of Ornamental Horticulture. 2017;20:54-60.
3. Choudhary S, Kashyap B, Choudhary RC, Jat ML. Effect of jeevamrit on growth and flowering of marigold. The Pharma Innovation Journal. 2021;10(8):1037-1040.
4. Devakumar N, Rao GGE, Nagaraj S, Shubha S, Khan I, Gouder SB. Organic Farming and activities of Organic Farming Research Centre. Research Bulletin. University of Agricultural Sciences, Bangalore, India; c2008, p. 18-27.
5. Dilta BS, Gupta YC. Effect of planting dates and pinching methods on growth and flower production in different cultivars of carnation (*Dianthus caryophyllus* L.). Progressive Horticulture. 2010;42:97-103.
6. Gharge CP, Angadi SG, Basavaraj N, Patil AA, Biradar MS, Mummigatti UV. Performance of standard carnation varieties under naturally ventilated poly house. Karnataka Journal of Agricultural Sciences. 2011;24(4):487-489.
7. Gomez AA, Gomez AA. Statistical procedures for agricultural research, John Wiley and Sons, New York; c1984. p. 680.
8. Karthikeyan S, Jawaharlal M, Jegadeeshwari V and Dhinesh D. Performance of carnation (*Dianthus caryophyllus* L.) cultivars under steel frame (medium cost) and wooden frame (low cost) polyhouses. International Journal of Advanced Biological Research. 2013;3:394-96.
9. Medeo K, Fatmi U, Singh D. Varietal evaluation of carnation (*Dianthus caryophyllus* L.) under naturally ventilated polyhouse conditions of Prayagraj. International Journal of Chemical Studies. 2019;7(5):2235-2239.
10. Mehmood MA, Khan MSA, Ahmad N. Growth, yield and quality of carnation (*Dianthus caryophyllus* L.) cultivars under lath house conditions. Journal of Ornamental Plants. 2014;4(1):27-32.
11. Nacho G. Evaluation of newly evolved genotypes of carnation (*Dianthus caryophyllus* L.) for growth and flowering parameters. MSc Thesis. Department of Floriculture and Landscape Architecture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan(H.P), India; c2016, p. 80.
12. Palekar S. Text book on Shoonya Bandovalada Naisargika Krushi. Swamy Anand, Agri Prakashana, Bangalore, India; c2006, p. 154.
13. Pamya L. Effect of organic fertilizers in conjunction with chemical fertilizers on the growth and flowering of gerbera (*Gerbera jamesonii*). MSc Thesis. Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP). India; c2018, p. 87.
14. Roni MZK, Taufique T, Shiam IH, Mehraj H, Jamal Uddin AFM. Study on growth and flowering of five carnation varieties. International Journal of Business, Social and Scientific Research. 2014;2(1):54-57.
15. Sharma P. Genetic evaluation of mutants of carnation (*Dianthus caryophyllus* L.). MSc Thesis. Department of Floriculture and Landscape Architecture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (H.P), India; c2020, p. 90.
16. Thakur D, Sharma BP, Bhalla R, Sharma U, Gupta RK, Jaryal R. Effect of jeevamrit on growth and flowering of iris (*Iris orientalis* Mill.) cv. ‘Frigia’. International Journal of Farm Sciences. 2023;13(1):56-62.
17. Verma LS, Mishra SK, Sharma D, Narayan K. Evaluation of different carnation varieties for the agro-climatic condition of Chhattisgarh. Asian Journal of Horticulture. 2012;7:318-32.