P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(5): 1889-1882

© 2020 IJCS

Received: 07-07-2020

Accepted: 02-08-2020

Tanika Parmar

Research Scholar, Department of Floriculture and Landscape Architecture, College of Horticulture, Dr YSPUHF, Nauni, Solan, Himachal Pradesh, India

HS Baweja

Professor and Head, Department of Floriculture and Landscape Architecture, College of Horticulture, Dr YSPUHF, Nauni, Solan, Himachal Pradesh, India

BS Dilta

Principal Scientist, Department of Seed Science and Technology, College of Horticulture, Dr YSP UHF, Nauni, Solan, Himachal Pradesh, India

PK Baweja

Senior Scientist, Department of Environmental Sciences, College of Forestry, Dr YSPUHF, Nauni, Solan, Himachal Pradesh, India

Corresponding Author:**Tanika Parmar**

Research Scholar, Department of Floriculture and Landscape Architecture, College of Horticulture, Dr YSPUHF, Nauni, Solan, Himachal Pradesh, India

Impact of environmental factors and mulching on growth, quality and yield of carnation (*Dianthus caryophyllus* L.) cv. 'Loris'

Tanika Parmar, HS Baweja, BS Dilta and PK Baweja

DOI: <https://doi.org/10.22271/chemi.2020.v8.i5z.10572>

Abstract

Research was conducted at Hi-tech farm of Department of Floriculture and Landscape Architecture, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan to evaluate the effects of different mulches and environmental conditions on growth, quality and yield of carnation cut flowers under naturally ventilated polyhouse conditions. Different types of mulch were replicated six times in a plot of 1.0×1.0 m size. Mulching with spent mushroom compost (M_1), grass (M_2), pine needles (M_3) along with control (M_0) was done 15 days after transplanting of rooted cuttings. The results revealed that plants mulched with spent mushroom compost (M_1) recorded maximum duration of flowering (28.77 & 28.97 days), minimum days taken to reach harvesting stage (141 & 132.33 days), highest number of cut flowers per plant (6.50 & 9.47) and vase life (18.30 & 23.37 days) during first and second flush, respectively as compared to control. The maximum temperature and relative humidity inside greenhouse were 39.8°C and 85 %, respectively. However, maximum soil temperature was recorded in the plots mulched with pine needles.

Keywords: Carnation, mulches, environmental conditions

Introduction

Carnation (*Dianthus caryophyllus* L.) is an important commercial cut flower crop of the world and occupies prime position in the domestic and international cut flower trade. Due to sweet fragrance, carnation is also being commercially utilized for extraction of essential oils in various countries mainly in France and The Netherlands. It is essential to produce flowers by adopting the technique(s) through which maximum benefits can be obtained by utilizing the finite resources such as water that is the main limiting factor nowadays globally. In this regards, use of mulches is the need of hour. In general, application of mulches helps to prevent rapid evaporation from the soil surface, suppresses weed infestation, catalyses microbial activities in soil through increasing soil temperature which improves the agro-physical properties as well as hydro thermal regimes of solum (Mullar and Kotshi, 1994) [4]. There is limited information on application of mulch materials on growing of carnation in general and in the state of Himachal in particular. Therefore, the present investigation was planned to determine the effect of mulches on growth, cut flower yield and quality of carnation cut flowers.

Material and methods

The present investigation was carried out at Hi-tech farm of Department of Floriculture and Landscape Architecture of Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2019-2020 (first flush during Standard Meteorological Weeks: 14-39 and second flush during Standard Meteorological Weeks: 40-9). Different types of mulches were replicated six times in a plot of 1×1 m size. The experiment was laid out in a completely randomized design (factorial) at a spacing of 20×20 cm. Mulching was done 15 days after transplanting of rooted cuttings. Well decomposed farmyard manure (FYM) @ 5 kg/m^2 was incorporated into soil before transplanting. The data was recorded for two consecutive flower flushes during the course of study. Data was statistically analysed by ANOVA test and correlation analysis at significance level of $P=0.05$.

Treatment Details

Types of Mulches: 4

M₀: No mulch (control)

M₁: Spent Mushroom Compost

M₂: Grass mulch

M₃: Pine needles

Results and discussion

Soil Temperature (°C)

The results revealed that pine needles had the highest soil temperature during first and second flush as compared to unmulched soil. According to their influence on soil temperature, mulching materials can be arranged in the following descending order: Pine needles > Grass mulch > Spent mushroom compost mulch. However, the organic mulches proved to be better in protected cultivation due to its ability of reducing soil temperature (Yordanova, 2017) [12]. Also, the organic mulches helped in regulating the soil temperature by reducing the daily range and creating a more constant temperature suitable for microbial activities in the soil. The results are in accordance with the recommendations of Pinamonti *et al.* (1995) [6] and Othieno (1973) [5].

Table 1: Effect of different mulches on soil temperature (°C)

Months	M ₀	M ₁	M ₂	M ₃
April	24.30	25.33	25.60	25.60
May	26.50	27.20	27.60	27.60
June	26.70	27.77	28.27	28.63
July	26.23	27.30	28.00	28.27
August	26.23	26.97	28.13	28.33
September	26.37	27.00	28.17	28.23
October	25.43	25.90	27.13	27.47
November	24.53	25.13	26.40	26.93
December	23.50	24.40	25.50	26.17
January	22.30	23.27	23.47	24.17
February	22.27	23.10	23.20	23.67
C.D. at 5%	0.25	0.20	0.23	0.21

Ambient Temperature (°C) and Relative Humidity (%)

The result depicted graphically in Fig 1 showed that during first flush, the minimum air temperature ranged from 32.0°C in 36th week (i.e. in the month of September) to 33.8°C in 30th week (i.e. in the month of July) and maximum air temperature varied between 35.7°C in 17th week (i.e. in the month of April) to 39.8°C in 24th week (i.e. in the month of June). During second flush, the maximum air temperature varied between 28.1°C in 7th week (i.e. in the month of February) to 37.1°C in both 40th and 45th week (i.e. in the month of October and November, respectively), whereas, minimum air temperature ranged from 32.0°C in 36th week (i.e. in the

month of September) to 33.8°C in 30th week (i.e. in the month of July).

The minimum relative humidity in the first flush, ranged from 50% in 22nd and 24th week (i.e. in the month of May and June, respectively) to 79% in 33rd week (i.e. in the month of August) and maximum relative humidity varied between 60% in 23rd week (i.e. in the month of June) to 85% in 30th and 31st week (i.e. in the month of August). During second flush, the maximum relative humidity varied between 54% in 9th week (i.e. in the month of February) to 75% in 40th week (i.e. in the month of October) whereas, minimum relative humidity ranged from 40% in 9th week (i.e. in the month of February) to 60% in 40th week (i.e. in the month of October). The results are in accordance with the findings of Priya *et al.* (2018) [7].

Growth Parameters

Days taken to reach harvesting stage

Days taken to reach harvesting stage were significantly influenced by organic mulches. It was recorded minimum (141 & 132.3 days in first and second flush, respectively) in spent mushroom compost as mulch increased the soil temperature that led to early maturing of plant. The results are in close proximity with the findings of Bohra *et al.* (2016a) [2]. Usman *et al.* (2005) [11] reported parallel results for plant growth by using straw mulch. It might be due to increase in soil water contents with least evaporation (Baumhardt and Jones, 2002; Zhang *et al.*, 2009; Yi *et al.*, 2011) [1, 14, 13].

Duration of Flowering

The maximum duration of flowering (28.77 & 28.97 days during first and second flush, respectively) could be attributed to simulative effects of mulching with spent mushroom compost mulch. The findings of Bohra *et al.* (2016b) [2] also revealed more duration of flowering in rose under mulched plots. The said organic mulch has ensured no weeds, hence, the plants kept on developing quality shoots which later on became reproductive in phased manner accounting for more duration of flowering.

Quality Parameter

Vase life

The vase life of cut flower was reported to be highest (18.3 & 23.3 days during first and second flush, respectively) in the cut flowers harvested from the plot mulched with spent mushroom compost. The results are in accordance with the findings of Bohra *et al.* (2016c) [2]. Higher vase life might also have been due to better accumulation of photosynthates. These results got the support from the findings of Sarkar and Roychoudhary (2003) [9].

Table 2: Response of carnation cv. 'Loris' to different mulch treatments

	First flush				Second flush			
	Days taken to reach harvesting	Duration of flowering	Number of cut flowers per plant	Vase life	Days taken to reach harvesting	Duration of flowering	Number of cut flowers per plant	Vase life
M ₀	149.67	26.30	4.40	16.73	137.67	27.50	8.43	21.83
M ₁	141.00	28.77	6.50	18.30	132.33	28.97	9.47	23.37
M ₂	149.00	26.90	4.67	17.80	135.67	27.43	8.73	22.83
M ₃	142.67	28.50	6.33	17.73	132.33	28.80	9.43	22.80
C.D. at 5%	1.56	0.59	0.50	1.046	2.21	1.25	0.49	0.98

Fig 2: Environmental conditions during crop growing periods

Fig 3: Influence of different mulches on growth parameters

Yield Parameter

Number of cut flowers per plant

The maximum number of cut flowers (6.50 & 9.57 during first and second flush, respectively) produced per plant in the plots with M₁ (spent mushroom compost mulch) can be attributed to the fact that mulching help to promote better growth of the plants leading to greater vegetative biomass production mainly due to moderating the soil moisture and temperature which ultimately increased the number of laterals per plant. These laterals in the due course of time become reproductive shoots bearing quality blooms producing more

number of cut flowers per plant. Stewart *et al.* (1998) ^[10] have observed positive influence of using spent mushroom compost mulch for improving crop yield and uptake of plant nutrients due to improvising the physico-chemical properties of solum (like reduced weight, soil clod and slide layer formation and increasing infiltration rate, water holding capacity etc). In another study, Li *et al.* (1998) ^[3] have also found drastic increase in crop yield by using spent mushroom compost mulch. Similar results were also obtained by Ram *et al.* (2003) ^[8] in geranium using organic mulch material.

Fig 4: Effect of different mulches on quality and yield parameters

Conclusion

Based on research work, it can be concluded that the maximum temperature and relative humidity inside greenhouse were 39.8°C and 85 % respectively. However, cut flowers with best growth, yield and quality were reported in plants mulched with spent mushroom compost. Hence, it can be used for commercial production.

References

1. Baumhardt RL, Jones OR. Residue management and tillage effects on soil-water storage and grain yield of dry land wheat and sorghum for a clay loam in Texas. *Soil and Tillage Research*. 2002; 68:71-82.
2. Bohra M, Kumar S, Singh CP, Visen A. Studies on effect of mulching materials on floral attributes of rose (*Rosa* spp.) cv. Lahar under tarai conditions of Uttarakhand state, India. *Research on Crops*. 2016; 17(2):324-30.
3. Li PP, Mao HP, Wang DH. Effect of medium residue from mushroom culture as a soilless culture medium for vegetable crops. *Chine Vegetables*. 1998; 5:12-15.
4. Mullar SKM, Kotshi J. Sustaining growth: soil fertility management in tropical small holdings. Margraf Verlag, Weikersheim, Germany, 1994, 486.
5. Othieno CO. The effect of organic mulches on yield and phosphorus utilization by plants in acid soils. *Plant and Soil*. 1973; 38:17-32.
6. Pinamonti F, Zorzi G, Gasperi F, Silvestri S. Growth and nutritional status of apple trees and grapevine in municipal solid-waste-amended soil. *Acta Horticulturae*. 1995; 383:313-21.
7. Priya KC, Bhagat IB, Kumar N. Influence of climatic parameters on performance of carnation (*Dianthus caryophyllus* L.) under protected cultivation. *International Journal of Chemical Studies*. 2018; 6(3):1599-1602.
8. Ram M, Ram D, Roy SK. Influence of an organic mulching on fertilizer nitrogen use efficiency and herb and essential oil yields in geranium (*Pelargonium graveolens*). *Bioresource Technology*. 2003; 87(3):273-78.
9. Sarkar I, Roychoudhary N. Effect of nitrogen and phosphorus on growth and flowering of carnation cv. 'Chaubad Mixed' under open conditions. *Environment and Ecology*. 2003; 21:696-98.
10. Stewart DPC, Cameron KC, Cornforth IS, Sedcok JR. Effects of spent mushroom substrate on soil physical conditions and plant growth in an intensive horticultural system. *Australian Journal of Soil Research*. 1998; 36(6):899-912.
11. Usman K, Ahmed E, Khan MU, Ahmad A, Imdad A, Iqbal J. Integrated weed management in Okra. *Pakistan Journal of Weed Science*. 2005; 11:55-60.
12. Yordanova M. Effect of different organic mulches on soil temperature during cultivation of fall broccoli. *Journal of Agriculture and Veterinary Science*. 2017; 10(10):57-62.
13. Yi L, Yufang S, Shenjiao Y, Shiqing L, Fang C. Effect of mulch and irrigation practices on soil water, soil temperature and the grain yield of maize (*Zea mays* L.) in Loess Plateau, China. *African Journal of Agricultural Research*. 2011; 6(10):2175-82.
14. Zhang SL, Lovdahl L, Grip H, Tong YA, Yang XY, Wang QJ. Effects of mulching and catch cropping on soil temperature, soil moisture and wheat yield on the Loess Plateau of China. *Soil and Tillage Research*. 2009; 102(1):78-86.