INFLUENCE OF ORGANIC MANURES ON GROWTH, FLOWERING, QUALITY AND YIELD OF CARNATION (*Dianthus caryophyllus*) CV. MASTER UNDER NATURALLY VENTILATED POLYHOUSE CONDITIONS OF PRAYAGRAJ, INDIA

ABSTRACT

An experiment entitled Influence of organic manures on growth, flowering, quality and yield of carnation *(Dianthus caryophyllus)* cv. Master under naturally ventilated polyhouse conditions of Prayagraj was conducted in naturally ventilated polyhouse of Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj, during November, 2022 to April, 2023 with an aim to identify the most suitable organic manure combination under the agroclimatic conditions of Prayagraj. There were thirteen treatments replicated thrice in Randomized Block Design (RBD). It was observed that treatment T_{11} (RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2) was significantly better in all the parameters studied like plant height (48.5 cm), number of primary branches (7.6), days taken to first bud initiation (93.5), flower diameter (6.3 cm), flower stalk length (77.2 cm), vase life (6.2 days), number of cut flowers per plant (5.6), number of cut flowers per 200 square meter (27,833.3).

Key words: *Carnation, Organic manures, FYM, Vermicompost, Neem Cake, Trichoderma*

1. INTRODUCTION:-

Carnation (*Dianthus caryophyllus L.*) belongs to the Caryophyllaceae family and holds a significant position as one of the world's most popular cut flower crops, consistently ranking among the top ten cut flowers in terms of demand and commercial value. It is a half-hardy perennial cultivated in various regions across the globe, believed to be native to the Mediterranean. It is characterized by its diploid chromosome number of 2n = 30. Carnations can be used in the garden for bedding, edging, borders, pots, and rock gardens in addition to producing cut flowers **(Dole and Wilkins, 2005).**

Excessive use of inorganic fertilizers for increasing the cut flower production has led to the leaching of nutrients causing soil hazards, altering the soil fertility and leading to pollution of soil and water bodies. They imposed disturbance in the ecosystem. Chemical fertilizers are

commonly employed in carnation cultivation due to their ability to rapidly release essential elements to the crop. However, their usage has been associated with certain negative effects on flower quality, as well as adverse impacts on soil health, water, and the environment. Organic manure is characterized as the product resulting from the controlled biological decomposition of organic matter. Organic matter has significant effect on the physico-chemical and biological characteristics of soil. Organic manures enrich the soil with organic matter, facilitating the gradual release of plant nutrients in a readily accessible form for crop utilization. Application of the organic manures and microbial agents make easy uptake of nutrients when required by the crop contrasting with chemical fertilizers **(Vanilarasu and Balakrishnamurthy, 2014).**

Organic manures like FYM, Neem cake, Vermicompost etc. has great potential to boost yield. They play a vital role in enhancing flower yield, maintain soil health and also to sustain productivity. Neem Cake is highly valued for its diverse composition of micro and macro nutrients. These nutrients play a crucial role in supporting plant growth and development. Its organic nature makes it an environmentally friendly choice for sustainable agriculture practices. One of the significant benefits of neem cake is its ability to control soil-borne pathogens and nematodes.

Vermicompost is the end product of the decomposition process involving various species of worms, such as red wigglers, white worms, and earthworms. These worms work to break down a combination of decomposing vegetable or food waste, bedding material, and vermicast. The process, known as vermicomposting, results in nutrient-rich organic matter suitable for enhancing soil fertility and plant growth. It has more nutrient contents and the availability of growth stimulating substances. In addition, there are many helpful microorganisms which assist in activities like nitrogen fixation, phosphorus solubilization and reduction of harmful micro-organisms **(Barik and Barik 2009).**

FYM is an important component of traditional farming systems and organic agriculture. It has been used for centuries as a natural fertilizer and soil conditioner. The primary objective of using FYM is to improve soil health, foster plant growth, and ensure the sustainable management of agricultural land.

Trichoderma has been widely studied and utilized as a biocontrol agent against plant pathogens, including fungi, in various agricultural systems. In case of carnation cultivation,

Trichoderma species have shown promising results as organic fungicides. It can be applied as a preventative measure to protect carnations from fungal diseases, such as Fusarium wilt (caused by *Fusarium oxysporum*) and Botrytis blight (caused by *Botrytis cinerea*).

2. MATERIALS AND METHODS:-

2.1 Geographical location and climatic conditions

Geographically, Prayagraj is situated in the South-Eastern part of Uttar Pradesh. It lies between the parallels of 24º77' and 25º47' north latitudes and 81º19' and 82º21' east longitudes. The area of Prayagraj district comes under agro climatic zone V (Upper Gangetic Plain region) and sub-zone of Central Plains. The climate ranges from dry sub-humid to semi-arid and the soil is alluvium calcareous sandy loam. This District experiences average maximum temperature range between 43º– 47ºC which may go as high as 48ºC during peak summers (May-June). The minimum average temperature is 2-4ºC, which may fall as low as 1ºC during peak winter months (December-January). The average rainfall of the district is 1042 mm and the monsoon season is spread between July-September.

2.2 Experimental details

The experiment was conducted in Randomized Block Design (RBD) with 13 treatments of organic manures with three replications in the Departmental Research Field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj during November, 2022 to April, 2023. Total number of treatments were thirteen *viz*. T_0-Control RDN (30:20:10 g/m^2 NPK), T_1 (RDN + FYM 5kg/m^2), T_2 (RDN + Vermicompost 2.5 kg/m^2), T3 (RDN + Trichoderma 10g/m^2), T4 (RDN + Neem cake 1kg/m^2), T5 (RDN + FYM 2.5 kg/ m^2 + Vermicompost 1.25 kg/m^2), T6 (RDN + FYM 5 kg/m^2 + Trichoderma 10g/m^2), T7 (RDN + FYM 5kg/m^2 + Neem cake 1kg/m^2), T8 (RDN + Vermicompost 2.5kg/m^2 + Trichoderma 10g/m^2), T9 (RDN + Vermicompost 2.5kg/m^2 + Neem cake 1kg/m^2), T10 (RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Trichoderma 10g/m^2), T11 (RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2), T12 (RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Trichoderma 10g/m^2 + Neem cake 1kg/m^2). Carnation cultivar Master was planted on 16th November, 2022 at a spacing of 20 cm x 20 cm.

3. RESULTS AND DISCUSSION

Plant height and Number of primary branches

Maximum plant height (48.5 cm) and number of primary branches was observed from the plants grown in treatment T_{11} containing RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2 significantly superior to rest of the treatments. The treatment combination of RDN (Recommended Dose of Nutrients) + FYM (Farm Yard Manure) + Vermicompost + Neem cake has shown significantly better plant height in carnations compared to other treatment combinations. This can be attributed to the synergistic effects of the various components. RDN provides essential nutrients in optimal proportions, promoting overall plant growth. FYM enhances soil structure and nutrient retention, leading to improved root development. Vermicompost enriches the soil with organic matter and beneficial microorganisms, facilitating nutrient uptake. Neem cake acts as a natural pesticide and also provides supplementary nutrients. Together, these components create a favorable environment for root expansion and nutrient absorption, resulting in taller, healthier carnation plants. The combination's balanced nutrient supply and disease-resistant properties contribute to the superior plant height observed. Similar findings were reported by **Pooja *et al.*, (2012); Bohra *et al.*, (2019) Pandey *et al.*, (2017).**

Days taken to first flower bud initiation

In terms of days taken to first bud initiation treatment T_{11} containing RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2 recorded minimum days taken to first bud initiation (93.5) whereas the maximum days were recorded in the treatment T_0 – Control (116.4). Organic manures likely promote early flowering by improving source-sink dynamics. This increases cytokinin synthesis in roots, aiding its swift transport to buds. This accelerates assimilate mobilization, facilitating the shift from vegetative to reproductive phase. Similar results were observed by **Ranjan *et al.*, (2014); Pandey *et al.*, (2017)**

Flower diameter (cm)

Data revealed that higher flower diameter was recorded in treatment T_{11} containing RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2 (5.3cm) whereas the minimum flower diameter was recorded in the treatment T_0- Control (4.2cm). This increase in flower diameter might be

due to better nutrient uptake, higher photosynthesis and excellent physiological, biological activities due to presence of organic manures which have resulted in rapid synthesis and translocation of photosynthetic from the source to developing flower bud and finally increase in flower diameter **Ranjan *et al.*, (2014); Sindhu *et al.*, (2010).**

Stalk length (cm)

Maximum flower stalk length was recorded in treatment T_{11} containing RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2 significantly superior to rest of the treatments. All treatments that included combinations with varying phosphorus levels exhibited significant effectiveness compared to the control. This can be attributed to the improved nutrient absorption in plants treated with organic manures, resulting in greater availability of assimilates required for enhancing flower stalk length. **Pooja *et al.*, (2012)**; **Sindhu *et al.*, (2010)** reported similar results.

Vase life (Number of days)

In terms of vase life treatment T_{11} containing RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2 recorded maximum vase life (6.2 days) whereas the minimum vase life was recorded in the treatment T0- Control (3.7 days). The use of organic fertilizer led to an increase in the vase life of carnations. This extension in vase life could be attributed to the stimulation of metabolic activity and the narrowing of the C:N ratio, which might have been facilitated by the substantial accumulation of carbohydrates. Furthermore, the use of the treatment combination RDN (Recommended Dose of Nutrients) + FYM (Farm Yard Manure) + Vermicompost + Neem cake has resulted in an improved vase life of carnation flowers compared to other treatment combinations. This improvement can be attributed to the combined effects of these components on flower quality and longevity. RDN supplies essential nutrients in optimal proportions, ensuring better flower health and resilience. FYM enhances soil structure and nutrient retention, allowing the flowers to access nutrients even after being cut. Vermicompost enriches the soil with organic matter and beneficial microorganisms, contributing to the flowers' overall vitality and vase life extension. Neem cake's presence helps in reducing post-harvest pests, minimizing petal damage and decay. The synergy of these components creates a favorable environment for cut flowers, resulting in longer-lasting and aesthetically pleasing carnations. These findings were supported by **Pooja *et al.*, (2012); Bohra *et al.*, (2019); Sindhu *et al.*, (2010).**

Number of cut flowers per plant/200m^2

Yield is an important parameter to decide the efficacy of a treatment. Data recorded on maximum number of flowers per plant (5.6) and maximum number of flowers per $200m^2$ (27,833) in treatment T_{11} containing RDN + FYM $2.5kg/m^2$ + Vermicompost $1.25kg/m^2$ + Neem cake $1kg/m^2$. The treatment combination of RDN (Recommended Dose of Nutrients) + FYM (Farm Yard Manure) + Vermicompost + Neem cake has led to a higher number of cut flowers per plant/$200m^2$ in carnations compared to other treatment combinations. This increase can be attributed to the combined effects of these components on plant growth and reproductive development. RDN supplies essential nutrients in optimal proportions, promoting robust flower bud initiation and development. FYM enhances soil fertility and water retention, ensuring continuous nutrient availability to support flower production. Vermicompost enriches the soil with organic matter and beneficial microorganisms, promoting healthy flowering and increased flower bud formation. Neem cake's presence provides natural pest resistance, preventing potential flower damage and loss. The synergy of these components creates an ideal growth environment, resulting in more abundant flower production in carnations, leading to higher yields of cut flowers per plant and per 200 square meter. Findings were in accordance with findings of **Sindhu *et al.*, (2010); Bohra *et al.*, (2019)**

Table 1. Effect of organic manures on plant height, number of primary branches, days taken to first flower bud initiation and flower diameter of carnation

Treatment Symbols	Treatment Combinations	Plant height (cm)	No. of primary branches	Days taken to first flower bud initiation	Flower diameter (cm)
		60 Days*	**60 Days***		
T_0	Control RDN (30:20:10 g/m^2 NPK)	31.9	4.4	116.4	4.2
T_1	RDN + FYM 5kg/m^2	45.1	6.1	114.0	5.1
T_2	RDN + Vermicompost 2.5 kg/m^2	34.1	6.2	100.9	4.9
T_3	RDN + Trichoderma 10g/m^2	40.5	5.9	102.9	4.8
T_4	RDN + Neem cake 1kg/m^2	34.6	6.2	102.4	4.3
T_5	RDN + FYM 2.5 kg/ m^2 + Vermicompost 1.25 kg/m^2	39.5	4.5	111.4	5.3
T_6	RDN + FYM 5 kg/m^2 + Trichoderma 10g/m^2	36.4	6.4	101.5	4.9
T_7	RDN + FYM 5kg/m^2 + Neem cake 1kg/m^2	37.5	4.8	101.3	5.0
T_8	RDN + Vermicompost 2.5kg/m^2 + Trichoderma 10g/m^2	35.9	4.7	107.4	5.3
T_9	RDN + Vermicompost 2.5kg/m^2 + Neem cake 1kg/m^2	46.5	5.8	99	6.0
T_{10}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 +Trichoderma 10g/m^2	35.5	5.1	115.7	5.5
T_{11}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2	48.5	7.6	93.5	6.3
T_{12}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Trichoderma 10g/m^2+ Neem cake 1kg/m^2	46.1	6.3	110.0	4.7
F-Test		**S**	**S**	**S**	**S**
SEd (±)		0.75	0.46	0.34	0.11

CV	2.33	9.80	0.55	2.64
$CD_{0.05}$	1.54	0.94	0.98	0.23

***Days after pinching**

Table 2: Effects of organic manures on stalk length, vase life of flowers, no. of flowers per plant and number of flowers per 200m^2 of carnation

Treatment Symbols	**Treatment Combinations**	Stalk Length (cm)	Vase Life (days)	Number of flower stalks per plant	Number of flower stalks per 200m^2
T_0	Control RDN (30:20:10 g/m^2 NPK)	61.0	3.7	4.2	21000.0
T_1	RDN + FYM 5kg/m^2	68.0	4.8	5.0	25166.7
T_2	RDN + Vermicompost 2.5 kg/m^2	65.7	5.2	5.1	25333.3
T_3	RDN + Trichoderma 10g/m^2	68.4	4.9	4.9	24500.0
T_4	RDN + Neem cake 1kg/m^2	67.9	5.1	4.5	22666.7
T_5	RDN + FYM 2.5 kg/ m^2 + Vermicompost 1.25 kg/m^2	68.1	4.9	4.9	24666.7
T_6	RDN + FYM 5 kg/m^2 + Trichoderma 10g/m^2	64.9	4.8	4.8	23833.3
T_7	RDN + FYM 5kg/m^2 + Neem cake 1kg/m^2	66.8	4.8	4.8	23833.3
T_8	RDN + Vermicompost 2.5kg/m^2 + Trichoderma 10g/m^2	70.6	4.5	4.4	22166.7
T_9	RDN + Vermicompost 2.5kg/m^2 + Neem cake 1kg/m^2	73.9	5.3	5.3	26333.3
T_{10}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 +Trichoderma 10g/m^2	66.3	4.9	4.9	24500.0
T_{11}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2	77.2	6.2	5.6	27833.3

T_{12}	RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Trichoderma 10g/m^2+ Neem cake 1kg/m^2	64.5	5.1	5.1	25500.0
F-Test		**S**	**S**	**S**	**S**
SEd (±)		0.69	0.24	0.13	660.76
CV		1.24	5.94	3.32	3.32
$CD_{0.05}$		1.42	0.49	0.27	1363.16

Conclusion:-

Based on the present investigation it is concluded that treatment T_{11} (RDN + FYM 2.5kg/m^2 + Vermicompost 1.25kg/m^2 + Neem cake 1kg/m^2) was found to be best in all the parameters like plant height, number of primary branches, days taken to first bud initiation, flower diameter, flower stalk length, vase life, number of cut flowers per plant, number of cut flowers per 200 square meter followed by T_9 (RDN + Vermicompost 2.5kg/m^2 + Neem cake 1kg/m^2), whereas minimum is recorded in treatment T_0 (Control).

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