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RESEARCH ARTICLE :

Effect of organic and inorganic fertilizers on dry matter production and flowering traits in carnation (*Dianthus caryophyllus* L.) cv. Soto under protected condition

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SUMMARY : An investigation was carried out to study the effect of organic and inorganic fertilizers on dry matter production and flowering traits in carnation (*Dianthus caryophyllus* L.) under protected condition at college of horticulture, Mudigere. The treatments consisted of different combinations of organic and inorganic fertilizers which were evaluated in randomized complete block design with three replications. The treatment T_{11} (*Azospirillum* + Phosphorus Solubilizing Bacteria + Farm Yard Manure + Vermicompost + 75 per cent NPK) recorded maximum total dry matter production (99.66 g) and it has taken minimum number of days for 50 per cent flowering (173.21), maximum flower reduction per plant per year (12.98) and vase life (12.52 days). Minimum total dry matter production (87.50 g), flowers per plant per year (9.25), per m^2 per year (305.25), vase life (9.12 days) with more number of days for 50 per cent flowering (205.41) were recorded in T_1 (100%RDF (250:80:200 g NPK+2 kg Farm Yard Manure /m^2).

KEY WORDS :
Organic fertilizers, Dry matter, Flower yield, Vase life

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BACKGROUND AND OBJECTIVES

The investigation was carried out in the Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere to evaluate the effect of organic and inorganic fertilizers on Carnation (*Dianthus caryophyllus* L.) cv. Soto under protected condition. Carnation is the favorite to be used as boutonnieres, bouquets, in corsages and in a wide range of floral arrangements. These are preferred to Rose and Chrysanthemum in several exporting countries, due to its long lasting keeping quality, attractive form, wide range of colours, ability to withstand long distance transportation and remarkable ability to rehydrate after continuous shipping.

Carnation is one of the important commercial flower crops of India, there is a

need to standardize the optimum dose of nutrients to increase the yield, improving the soil structure, physico-chemical properties under potential environment. The indiscriminate and continuous use of chemical fertilizers has lead to an imbalance of nutrients in soil which has adversely affected the soil health, affecting the yield and quality of the product.

Therefore, the integrated use of nutrients is the need of hour. The use of organic manures and biofertilizers along with the balanced use of chemical fertilizers is known to improve physical, chemical and biological properties of soil, pH, water holding capacity and adds important nutrients to the soil, thus increase the nutrient availability and its ultimate absorption by plant, besides improving the efficiency of applied fertilizers.

RESOURCES AND METHODS

Investigation was tried to study the effect and to determine the ideal combination of different sources of nutrients and dry matter accumulation for better growth, yield and quality of cut flowers. The study was consisted of 11 treatment *viz*. T_1 (100% RDF (250:80:200 g NPK + 2 kg FYM/m^2), T_2 (*Azospirillum* + 75% RDN + 100% RDP and K), T_3 (PSB + 75% RDP + 100% RDN and K), T_4 (*Azospirillum* + FYM + 75% RDF), T_5 (*Azospirillum* + VC + + 75% RDF), T_6 (PSB + FYM + 75% RDF), T_7 (PSB + VC + 75% RDF), T_8 (*Azospirillum* + PSB + 75% RDN and P + 100% RDK), T_9 (*Azospirillum* + PSB + FYM + 75% RDF), T_{10} (*Azospirillum* + PSB + VC + 75 % RDF), T_{11} (*Azospirillum* + PSB + FYM + VC + 75% RDF) combinations and replicated thrice with the spacing of 20x15 cm in 1x1 m^2 bed. The recommended dose of organic manures like vermicompost at 500 g/m^2 and FYM at 2 kg/m^2 and Biofertilizers *Azospirillum* and PSB at 60 g/m^2 each were mixed in the soil thoroughly and planting was done and the recommended dose of nitrogen, phosphorus and potash fertilizers (250:80:200 g/m^2) were calculated according to the treatment details and divided into six splits and applied at bimonthly interval after the single pinch.

When the plants are growing, the nets were lifted accordingly. The bottom net of 7.5 x 7.5 cm was laid out at 15 cm height from ground level. Second layer with mesh size of 12.5 X 12.5 cm and third and further layers of 15 X 15 cm mesh size were laid out at 15 cm interval.

Dry matter production was recorded in different plant parts (Leaves, Stem, Flower, Root and Total) at peak flowering by uprooting the three plants randomly in each treatment. The leaves, stem, flowers and roots were separated and fresh weight was recorded. Then they were oven dried separately at a temperature of 65^0C till it reached constant weight. The total dry matter production was calculated by adding dry weight of leaves, stem, flowers and roots and expressed in g/plant.

Minimum days to 50 per cent flowering have been observed in treatments and total number of flowers per plant and per square meter were recorded by counting at each harvest. Three flowers from each treatments were kept in conical flasks to observe the vase life of carnation.

OBSERVATIONS AND ANALYSIS

The dry matter production is general indicative of the efficiency of the crop and different sources of nutrients. Significantly it has increased in leaves, stem, flower, root and whole plant by influence of vermicompost, *Azospirillum*, PSB, FYM and 75 per cent of RDF. It is the integral parameter of crop growth over entire growing period and it is related to yield, assimilatory surface area, leaf area index, leaf area and growth. The increase in leaf area has resulted in the increased dry matter accumulation and increased yield in the treated plants with organics. These results are in accordance with the results obtained by Swaminathan *et al*. (1999) in tuberose and Singh (2005) in rose.

The dry matter production in leaves, stem, flower, root and whole plant was differed significantly at peak flowering stage due to the application of organics, inorganics and biofertilizers at all the stages of growth (Table 1). Maximum dry matter production was noticed in T_{11} (38.93, 50.94, 4.40, 5.39 and 99.66 g/plant, respectively) and was on par with T_{10} (38.51, 49.62, 4.18, 5.21 and 97.52 g/plant, respectively) and minimum was recorded in 100 per cent RDF (32.99, 47.65, 3.10, 3.76 and 87.50 g/plant, respectively).

Apart from the reasons mentioned earlier, enhanced growth parameters like plant height, number of leaves, leaf area, stem girth etc., due to *Azospirillum* may also be attributed to the influence of nitrogen, the chief constituent of protein essential for formation of protoplasm, which enhances cell division and cell enlargement. PSB solubilizes the phosphorus, vermicompost is a component of micro and

macronutrients, growth regulators which provides the nitrogen to the plants leads to more amount of dry matter in plant.

The treatment T_{11} with *Azospirillum* + Phosphorus Solubilizing Bacteria + Farm Yard Manure + Vermicompost + 75 per cent RDF (Table 2) was superior with respect to flowering parameters like minimum days for 50 per cent flowering (173.21), maximum flower yield per plant (12.98) followed by T_{10} (*Azospirillum* + Phosphorus Solubilizing Bacteria + Vermicompost + 75 per cent RDF). The maximum days to 50 per cent flowering (205.41), minimum flower yield per plant (9.25) was recorded in T_1 (100 per cent RDF). Similar effects of organic and inorganic fertilizers were also reported by Renukaradya *et al*. (2011), Balla *et al*. (2007) and Batia *et al*. (2007)in carnation. Decreased days to 50 per cent flowering, increased more number of flowers per plant and per plant may due to increased leaf area, more dry matter accumulation in on plant at flowering stage by influence of vermicompost with 75 per cent recommended dose of fertilizer.

The effect of chemical fertilizers, organic manures and biofertilizers on vase life (12.52 days) was observed in plants receiving *Azospirillum* + Phosphorus Solubilizing Bacteria + Farm Yard Manure + Vermicompost + 75 per cent RDF, (Table 2) which can be ascribed to lower physiological loss in weight and higher water uptake. Similar effects of vermicompost

Table 1: Influence of organic and inorganic fertilizers on dry matter production in different plant parts and total dry matter content in Carnation (*Dianthus caryophyllus* L.) cv. Soto under protected condition

Treatments		Dry matter production (g)				
		Leaves	Stem	Flower	Root	Total
T_1	100%RDF (250:80:200 g NPK+2 kg FYM /m^2)	32.99	47.65	3.10	3.76	87.50
T_2	*Azospirillum* + 75% RDN + 100% RDP and K	35.63	47.96	3.42	4.41	91.42
T_3	PSB + 75% RDP + 100% RDN and K	37.22	47.22	3.93	4.93	93.30
T_4	*Azospirillum* + FYM + 75% RDF	36.52	48.52	3.31	4.32	92.67
T_5	*Azospirillum* + VC + 75% RDF	36.22	48.57	3.85	4.84	93.48
T_6	PSB + FYM + 75% RDF	36.54	49.56	3.51	5.03	94.64
T_7	PSB + VC + 75% NPK	36.67	48.65	3.45	4.44	93.21
T_8	*Azospirillum* +PSB +75% RDNand P +100% RDK	36.94	50.26	3.96	5.03	96.19
T_9	*Azospirillum* + PSB + FYM + 75% NPK	37.19	48.81	3.51	4.61	94.12
T_{10}	*Azospirillum* + PSB + VC + 75 % NPK	38.51	49.62	4.18	5.21	97.52
T_{11}	*Azospirillum* + PSB + FYM + VC + 75% NPK	38.93	50.94	4.40	5.39	99.66
S.E.±		0.02	0.02	0.03	0.05	0.09
C.D. (P=0.05)		0.05	0.05	0.09	0.15	0.26

Table 2 : Effect of organic and inorganic fertilizers on flowering traits of Carnation (*Dianthus caryophyllus* L.) cv. Soto under protected condition

Treatments		Days for 50 % flowering	Vase life (days)	Flowers production Per plant per year
T_1	100% RDF (250:80:200 g NPK + 2 kg FYM /m^2)	205.41	9.12	9.25
T_2	*Azospirillum* + 75% RDN + 100% RDP and K	197.33	10.55	9.81
T_3	PSB + 75% RDP + 100% RDN and K	192.53	11.51	9.63
T_4	*Azospirillum* + FYM + 75% RDF	190.46	10.87	9.56
T_5	*Azospirillum* + VC + + 75% RDF	186.07	10.96	10.91
T_6	PSB + FYM + 75% RDF	178.61	10.74	10.84
T_7	PSB + VC + 75% RDF	191.37	10.45	11.37
T_8	*Azospirillum* + PSB + 75% RDN and P + 100% RDK	179.41	11.98	12.06
T_9	*Azospirillum* + PSB + FYM + 75% RDF	189.84	10.48	9.91
T_{10}	*Azospirillum* + PSB + VC + 75 % RDF	178.01	12.01	12.54
T_{11}	*Azospirillum* + PSB + FYM + VC + 75% RDF	173.21	12.52	12.98
S.E.±		1.07	0.14	0.04
C.D. (P=0.05)		3.17	0.43	0.14

on vase life are also reported by Renukaradya *et al*. (2011) and Balla *et al*. (2007) in carnation.

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