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STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE GROWTH PARAMETERS OF *CHRYSANTHEMUM* CV. MDU-1

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Abstract

The present investigation on the effect of integrated nutrient management on growth parameters of *chrysanthemum* cv. MDU-1 was carried out at the Floriculture complex, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar. The experiment was laid out in Randomized Block Design (RBD) with 11 treatments with different combinations of inorganic fertilizers (75% RDF, 100% RDF), soil applied organic manures (FYM @ 25 t ha^{-1} and Vermicompost @ 5 t ha^{-1}) and organic foliar sprays (Panchakavya @ 3%, humic acid @ 0.2% and EM 1:1000 dilutions). Among all the treatments, application of 75 % RDF + Vermicompost @ 5t ha^{-1} along with foliar spray of 0.2% humic acid (T_9) recorded maximum values for plant height (20.44 cm, 42.26 cm, 62.56 cm, 72.95 cm at 40, 80,120 and 160DAP respectively), Number of leaves $plant^{-1}$ (46.31, 82.67, 120.94 and 132.73 at 40, 80, 120 and 160 DAP respectively), leaf area (988.25 cm^2 at peak flowering period) and number of branches $plant^{-1}$ (26.83 at final harvest). The minimum values for the traits were noticed with control T_1 - 100 % RDF (125:120:20 kg NPK ha^{-1}).

Key words : *Chrysanthemum*, RDF, vermicompost, panchakavya, humic acid and EM.

Introduction

Chrysanthemum was named by Carolus Linnaeus from two greek prefixes, 'chrys', means golden (the colour of the original flowers) and 'anthemon', means flower. The genus *Dendranthema* belongs to the family "Asteraceae". The centre of origin is Northern hemisphere mainly Europe and Asia. It is partly woody erect perennial herb growing upto 1 m height. The inflorescence consists of many flower heads. Each flower head has numerous florets namely the disc florets and ray florets. The erect and tall growing cultivars are suitable for background planting in borders and as cut flowers. The decorative and fifty bloomed small-flowered cultivars are ideal for garland making and hair decoration. The extra large bloomed cultivars are priced for their exhibition value (Ezhilkavitha *et al.,* 2006). The number of species varies from 100 to 200 (Carter, 1980). It was brought to Japan by Buddhist monks in 400 AD. In Japan it is recognized as national flower. Japanese emperors loved these flowers and adorned their thrones with these flowers. Even today, a number of Japanese cities hold spectacular annual *chrysanthemum* exhibitions. In India, it occupies a place of pride both as a commercial flower crop and as a popular exhibition flower. In India, 11.05 lakh hectares of area under *chrysanthemum* cultivation with a production of flowers are estimated to be 106.76 thousand MT of loose flowers and 6.03 lakh numbers of cut flowers (Anon., 2016).

In general, plant nutrients are supplied through chemical fertilizers. The continuous use of chemical fertilizers has led to an imbalance of nutrients in soil which has adversely affected the soil health, affecting the yield and quality of the produce. Therefore, the integrated nutrient management is need for the sustainable crop production. INM practices involving judicious combination of organic manures, bio-fertilizers and chemical fertilizers can be feasible and viable for sustainable agriculture on

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a commercial and profitable scale (Rakesh *et al*., 2015). In addition they are eco-friendly, easily available and cost effective. Therefore, present study focused on the use of organic manures such as farm yard manure, vermicompost and foliar spray of panchakavya, humic acid and effective microorganism (EM) with optimum dosage of fertilizers.

Materials and Methods

The present investigation was carried out at the Floriculture complex in Department of Horticulture, Faculty of Agriculture, Annamalai University. An experiment was laid out in Randomized Block Design with three replications and 11 treatments. The schedule is given below,

T_1 - 100 % RDF (125:120:20 kg NPK ha^{-1}) control

T_2 - 100 % RDF + FYM @ 25 t ha^{-1}

T_3 - 75 % RDF + FYM @ 25 t ha^{-1}

T_4 - 100 % RDF + Vermicompost @ 5t ha^{-1}

T_5 - 75 % RDF + Vermicompost @ 5t ha^{-1}

T_6 - 75 % RDF + FYM @ 25 t ha^{-1}+ Panchakavya 3%

T_7- 75 % RDF + Vermicompost @ 5t ha^{-1} + Panchakavya 3%

T_8 - 75 % RDF + FYM @ 25 t ha^{-1}+ Humic acid 0.2%

T_9 - 75 % RDF + Vermicompost @ 5t ha^{-1} + Humic acid 0.2%

T_{10} - 75 % RDF + FYM @ 25 t ha^{-1}+ EM (1:1000 dilutions)

T_{11} - 75 % RDF + Vermicompost @ 5t ha^{-1} + EM (1:1000 dilutions)

One month old seedlings of *chrysanthemum* cv. MDU-1 with uniform growth were transplanted at a spacing of 30 × 30 cm. FYM and vermicompost were added at the time of land preparation. While, foliar application of organic substances like humic acid, panchakavya and effective microorganisms were applied as per treatments on 30, 60 and 90 DAP. Whereas, chemical fertilizers, a basal dose of half N, full P_2O_5 and K_2O were applied as per treatments at the time of transplanting through urea, SSP and muriate of potash. The remaining half dose of nitrogen was applied on 30 DAP. The observations on growth parameters of garland chrysanthemum cv. MDU-1 were recorded and analysed statistically as per the method given by Panse and Sukhatme, (1978).

Results and Discussion

Plant height (cm) in *chrysanthemum* cv. MDU-1

The data recorded on plant height of *chrysanthemum* cv. MDU-1 influenced by different stages of crop growth are furnished in table1. It clearly showed the gradual increase in plant height in all the treatments at all the stages of observations. Significant effect was observed in all the stages of plant growth except at 40 DAP. Maximum plant heights (20.44, 42.26, 62.56 and 72.95 cm at 40, 80, 120 and 160 DAP respectively) were recorded in 75 % RDF + vermicompost @ 5t ha^{-1} + humic acid 0.2 % (T_9). The next best values were (20.36, 41.66, 61.44 and 72.11 cm at 40, 80, 120 and 160 DAP respectively) observed in T_7- 75 % RDF + Vermicompost @ 5t ha^{-1} + Panchakavya 3%. The minimum plant heights were recorded in 100 % RDF- Control (T_1). The increase in plant height on the combined application of vermicompost and humic acid may be due to their beneficial effect in combination with the inorganic fertilizers. Vermicompost, a rich source of micronutrients, Fe and Zn might have enhanced the micro flora and enzymatic activity, which may have augmented the plant growth (Chaitra and Patil, 2007). Similar observations were also made earlier by Ezhilkavitha and Haripriya, (2006) in *chrysanthemum*, Shahin Sultana *et al.,* (2015) in zinnia and Subrata Raha, (2015) in c*hrysanthemum*.

Number of leaves $plant^{-1}$ in *chrysanthemum* cv. MDU-1

The data relating to the effect of integrated nutrient management on number of leaves $plant^{-1}$ are given in table 2. Number of leaves $plant^{-1}$ increased gradually from every stage of development in all treatments. Except 40 DAP all the stage of plant growth showed significant difference. The maximum number of leaves $plant^{-1}$ were observed in 75 % RDF + vermicompost @ 5t ha^{-1} + humic acid 0.2 % (T_9) which recorded 46.31, 82.67, 120.94 and 132.73 at 40, 80, 120 and 160 DAP respectively. This was followed by 75 % RDF + vermicompost @ 5t ha^{-1} + panchakavya 3 % (T_7) with 44.41, 78.42, 116.59 and 128.59 leaves $plant^{-1}$ respectively. Least number of leaves $plant^{-1}$ were obtained in the treatment 100 % RDF- Control (T_1) with 34.22, 62.43, 75.63 and 85.98 leaves $plant^{-1}$ respectively.

The improvement of growth parameters may be due to the influence of vermicompost with its richness of both micro and macro nutrients besides having certain plant growth promoters, various organic acids, humus forming microbes and sustained availability of nutrients throughout the crop period by the nitrogen fixers present in it (Jayaparadha and Shakila, 2002). The results are in conformity with the findings of Chandrikapure *et al.,* (1999) in marigold, Kumar *et al.,* (2003) and Kulkarni, (1996) in china aster.

Table 1: Effect of integrated nutrient management on plant height (cm) in chrysanthemum cv. MDU-1.

Treatment No.	Treatments	Plant height (cm)			
		40 DAP	80 DAP	120 DAP	160 DAP
T_1	100 % RDF (125:120:20 kg NPK/ha)	19.70	32.19	42.16	53.04
T_2	100 % RDF + FYM @ 25 t ha^{-1}	19.83	34.78	45.03	55.73
T_3	75 % RDF + FYM @ 25 t ha^{-1}	19.79	32.90	43.54	53.78
T_4	100 % RDF + Vermicompost @ 5t ha^{-1}	20.05	37.48	53.47	66.80
T_5	75 % RDF + Vermicompost @ 5t ha^{-1}	19.92	36.32	52.98	66.16
T_6	75 % RDF + FYM @ 25 t ha^{-1} + Panchakavya 3%	20.12	40.84	59.26	70.04
T_7	75 % RDF + Vermicompost @ 5t ha^{-1} + Panchakavya 3%	20.36	41.66	61.44	72.11
T_8	75 % RDF + FYM @ 25 t ha^{-1} + Humic acid 0.2%	20.28	41.08	60.39	71.22
T_9	75 % RDF + Vermicompost @ 5t ha^{-1} + Humic acid 0.2%	20.44	42.26	62.56	72.95
T_{10}	75 % RDF + FYM @ 25 t ha^{-1} + EM (1:1000 dilution)	19.84	35.02	49.57	60.08
T_{11}	75 % RDF + Vermicompost @ 5t ha^{-1} + EM (1:1000 dilution)	20.09	39.73	57.43	69.76
S. Ed		—	0.09	0.10	0.11
CD (p = 0.05)		NS	0.20	0.22	0.24

Table 2: Effect of integrated nutrient management on number of leaves $plant^{-1}$ in chrysanthemum cv. MDU-1.

Treatment No.	Treatments	Number of leaves			
		40 DAP	80 DAP	120 DAP	160 DAP
T_1	100 % RDF (125:120:20 kg NPK ha)	34.22	62.43	75.63	85.98
T_2	100 % RDF + FYM @ 25 t ha^{-1}	36.72	69.28	80.46	90.47
T_3	75 % RDF + FYM @ 25 t ha^{-1}	34.46	65.24	76.26	86.62
T_4	100 % RDF + Vermicompost @ 5 t ha^{-1}	40.08	75.12	93.23	104.32
T_5	75 % RDF + Vermicompost @ 5 t ha^{-1}	39.78	73.27	88.47	98.74
T_6	75 % RDF + FYM @ 25 t ha^{-1} + Panchakavya @ 3%	40.56	77.79	103.74	114.47
T_7	75 % RDF + Vermicompost @ 5 t ha^{-1} + Panchakavya @ 3%	44.41	78.42	116.59	128.59
T_8	75 % RDF + FYM @ 25 t ha^{-1} + Humic acid @ 0.2%	42.55	76.48	111.42	122.36
T_9	75 % RDF + Vermicompost @ 5 t ha^{-1} + Humic acid @ 0.2%	46.31	82.67	120.94	132.73
T_{10}	75 % RDF + FYM @ 25 t ha^{-1} + EM @ 1:1000 dilution	38.44	70.13	82.67	93.38
T_{11}	75 % RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 dilution	40.24	75.43	99.89	110.43
S. Ed		0.96	0.98	1.03	1.45
CD (p = 0.05)		2.01	2.05	2.18	3.04

Leaf area (cm^2) and number of branches $plant^{-1}$ in *chrysanthemum* cv. MDU-1

The data on the effect of integrated nutrient management on leaf area and number of branches $plant^{-1}$ were presented in table 3. The higher leaf area and number of branches $plant^{-1}$ were observed in the 75 % RDF + vermicompost @ 5t ha^{-1} + humic acid 0.2 % (T_9), with the value of 988.25 cm^2 and 26.83 respectively at peak flowering stage and at final harvest. This was followed by 75 % RDF + vermicompost @ 5t ha^{-1} + panchakavya 3 % (T_7) with leaf area of 981.36 cm^2 and 25.73 branches respectively at peak flowering stage and at final harvest. The lesser leaf area and number of branches $plant^{-1}$ were noticed in T_1.

Growth is an important character which is responsible for crop yield. Application of reduced recommended dose of fertilizer, organic manures such as vermicompost, farm yard manure (FYM) and foliar spray of organic substances such as panchakavya, humic acid and effective microorganisms (EM) significantly influenced growth parameters *viz.*, leaf area and number of branches $plant^{-1}$. The morphological characters were significantly influenced by integrated nutrient management as the age of the crop progressed from 40 to 160 DAP. The reason may be due to foliar application of humic acid, with increased meristematic activity in the plant and enhanced supply of photosynthates due to the growth promoters present in it. It could also have been due to biological effects such as increased beneficial enzymatic activities, increased populations of beneficial microorganisms or the presence of biologically active plant growth-influencing substances such as plant growth

Table 3: Effect of integrated nutrient management on leaf area (cm^2) and number of branches $plant^{-1}$ in chrysanthemum cv. MDU-1 at final harvest.

Treatment No.	Treatments	Leaf area (cm^2) (At final harvest)	Number of brances $plant^{-1}$ (At final harvest)
T_1	100 % RDF (125:120:20 kg NPK ha)	753.26	19.08
T_2	100 % RDF + FYM @ 25 t ha^{-1}	807.18	20.73
T_3	75 % RDF + FYM @ 25 t ha^{-1}	776.29	19.79
T_4	100 % RDF + Vermicompost @ 5 t ha^{-1}	899.29	22.98
T_5	75 % RDF + Vermicompost @ 5 t ha^{-1}	869.37	22.23
T_6	75 % RDF + FYM @ 25 t ha^{-1} + Panchakavya @ 3%	924.45	24.29
T_7	75 % RDF + Vermicompost @ 5 t ha^{-1} + Panchakavya @ 3%	981.36	25.73
T_8	75 % RDF + FYM @ 25 t ha^{-1} + Humic acid @ 0.2%	955.38	25.21
T_9	75 % RDF + Vermicompost @ 5 t ha^{-1} + Humic acid @ 0.2%	988.25	26.83
T_{10}	75 % RDF + FYM @ 25 t ha^{-1} + EM @ 1:1000 dilution	838.95	21.43
T_{11}	75 % RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 dilution	911.85	23.69
S. Ed		2.81	0.20
CD (p = 0.05)		5.89	0.42

regulators or plant hormones in the humic acid (Arancon *et al*., 2006). Similar findings have been reported by Kulkarni *et al.,* (1996) in china aster, Sunitha and Hunje, (2010) and Gupta *et al.,* (1999) in marigold.

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