Impact of Integrated Nutrient Management on Primary Nutrient Uptake and Postharvest Soil Availability of Chrysanthemum cv. MDU-1

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Abstract: The present study was carried out the effect of integrated nutrient management on primary nutrient uptake and postharvest soil availability of chrysanthemum cv. MDU-1. Application of 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 the all treatments tested, 75% RDF + Vermicompost @ 5 t ha^{-1} + Humic acid 0.2% (T_9) recorded significantly increased NPK uptake and postharvest soil residual NPK status. The next best treatment also responds well due to 75% RDF + Vermicompost @ 5 t ha^{-1} along with foliar spray of 3% panchakavya (T_7).

Keywords: Chrysanthemum, humic acid, EM, RDF, vermicompost, panchakavya, nutrient uptake and soil residual NPK

I. Introduction

Chrysanthemums sometimes called mums or chrysanths, are flowering plants of the genus *Dendranthema* in the family Asteraceae. They are native to Asia and northeastern Europe. While the flower is regarded as a symbol for happiness, joy and love. It occupies a prominent place in ornamental horticulture and is one of the commercially exploited flower crop. In many countries, including the United States and Japan, it is considered as the number one flower crop. It is mainly grown for cut flower and loose flower for garland making, general decoration, hair adornments and religious function. The erect and tall growing cultivars are suitable for background planting in borders, gardening in patios 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). In India, it occupies a place of pride both as a commercial flower crop and as a popular exhibition flower. Recently, garland chrysanthemum is becoming attractive to the growers as well as users, as it has great potential for local and export market.

Increased flower production, quality of flowers and perfection in the form of plants are the important objectives to be reckoned in commercial flower production. By using inorganic fertilizers, one can get higher yield but indiscriminate use of chemical fertilizers has adverse and ill effects on the soil structure, environment, flora and fauna. Recently, there is fall in mineral fertilizers consumption due to unprecedented hike in price of fertilizers and also soil and water pollution has aggravated the problem of soil health (Bhatia and Gupta, 2007). The increasing costs of fertilizers prevent their use by poor farmers (Adhikary and Gantayet, 2012). Further, it is believed to be a potential crop of Tamil Nadu, its yield and quality levels are low especially in coastal region. Therefore, nowadays attention is shifted towards integrated nutrient management by using organic manures and reduced recommended dose of chemical fertilizers. The role of integrated nutrient management is to make the soil healthy as well as make unavailable form of soil nutrients to available form by enhancing mineralization and solubilization process. Adding organic manures and microbial agents in the soil make easy uptake of nutrients when compared with the chemical fertilizers alone (Vanilarasu and Balakrishnamurthy, 2014). Keeping this in view, the present investigation was undertaken to study the influence of integrated nutrient management on primary nutrient uptake and postharvest soil availability of chrysanthemum.

II. 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 @ 5 t ha^{-1}

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

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

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

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

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

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

T_{11} - 75 % RDF + Vermicompost @ 5 t 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 x 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).

III. Result and Discussion

III. 1 Impact of integrated nutrient management on NPK uptake of chrysanthemum cv. MDU-1

The data on the nutrient content of nitrogen, phosphorus and potassium on plants are represented in table 1. All the treatments showed significant difference for NPK uptake plant^{-1}. The higher NPK uptake was observed in T_9 (75 % RDF + Vermicompost @ 5 t ha^{-1}+ humic acid 0.2%) with the values of 493.50 mg kg^{-1}, 164.48 mg kg^{-1} and 164.48 mg kg^{-1} respectively, followed by T_7 (75 % RDF + Vermicompost @ 5 t ha^{-1}+ Panchakavya 3%) with the values of 451.55 mg kg^{-1}, 143.96 mg kg^{-1} and 178.01 mg kg^{-1} respectively. While the lesser NPK uptake was observed in T_1- 100% RDF- control (164.74 mg kg^{-1}, 49.30 mg kg^{-1} and 70.54 mg kg^{-1}).

This may be the reason due to that, the major nutrients *viz.*, nitrogen, phosphorus and potassium play a vital role in the plant physiology and growth and these elements cannot be replaced by any other. Nitrogen is a major constituent of proteins, enzymes, chlorophyll and nucleic acid. It is involved in the cell division, cell enlargement and in respiration. Phosphorus plays a major role in the development of reproductive parts and root formation. Potassium plays a major role in activating many enzymes to induce flowering, fruit set, and in translocation of carbohydrates. Further, vermicompost when added to soil, with the action of microorganisms, complex nitrogenous compounds slowly breakdown and its availability in the form of nitrate N is steady throughout crop growth (Karuna *et al*. (1999). Earlier reports by Subbiah and Asija (1956) also revealed that increased uptake of N, P and K with the application of vermicompost, which could be attributed to the solubilisation effect of plant nutrients by the addition of vermicompost. Further, vermicompost containing higher available N, P and K contents and rich population of microbes might have degraded and mobilized the occluded soil nutrients to available form. Several enzymes and hormones present in vermicompost resulted in increased availability and uptake of nutrients by the plants. This is supported by Morselli *et al*. (1999).

Humic acid contains soluble form of nitrogen, phosphorus, phenolic groups and dicarboxyl groups, which leads to increased plant nutrient uptake. It also increasing root growth due to increased cell elongation or root cell membrane permeability leads to increased water uptake. Further, it can produce root systems with increased branching and more number of fine roots, leads to increased nutrients uptake (Vaughan and Malcolm, 1982). Similar results were reported by Lee and Barlett (1976) in maize and Siminis *et al*. (1998) in tomato.

III. 2 Impact of integrated nutrient management on Post harvest soil residual NPK status of chrysanthemum cv. MDU-1

The data on the post harvest available soil NPK are presented in table 2. Significant results were observed on available soil NPK in all the treatments. Among all the treatments, T_9 (75 % RDF + Vermicompost @ 5 t ha^{-1} + humic acid 0.2%) recorded the higher available of post harvest soil residual NPK status with the values of 224.28 kg ha^{-1} , 25.85 kg ha^{-1} and 247.89 kg ha^{-1} respectively. This was followed by T_7 (75 % RDF + Vermicompost @ 5 t ha^{-1} + Panchakavya 3%) observed the available NPK of 207.65 kg ha^{-1}, 25.85 kg ha^{-1} and 246.94 kg ha^{-1} respectively. The lesser values of 105.14 kg ha^{-1}, 11.23 kg ha^{-1} and 160.27 kg ha^{-1} were noticed with T_1 - 100% RDF- control. The residual availability of nutrients will be very much helpful to the succeeding crop to be grown in the field. In the present study, the available N, P and K contents of the soil after crop harvest was positively influenced by application of organic manures along with humic acid. Similar results were reported by Airadevi (2014) and Nomita Laishram (2013) in chrysanthemum. This might be due to favorable soil physical properties and solubilizing effect of native soil nutrients due to organic acids produced during decomposition of vermicompost and solubilizing effect of micro organisms. In addition, humic acid formed during decomposition of vermicompost had greater influence in stimulating the roots and speeding up the developmental process of plant which in turn resulted in better available NPK in soil (Chaitra, 2006, Rajdurai and Beavlah, 2000). Further, Sen (2003) observed that combination of organic manures and inorganic fertilizers increased available N, P, K contents in the soil thereby improving the soil health and justified the need of balanced fertilization in vertisol.

IV. References

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Table.01. Effect of integrated nutrient management on NPK uptake in chrysanthemum cv. MDU-1 (mg kg^{-1})

Treatment No.	Treatments	N	P	K
T_1	100 % RDF (125:120:20 kg NPK ha)	164.74	49.30	70.54
T_2	100 % RDF + FYM @ 25 t ha^{-1}	213.24	80.19	112.37
T_3	75 % RDF + FYM @ 25 t ha^{-1}	180.50	77.08	92.42
T_4	100 % RDF + Vermicompost @ 5 t ha^{-1}	405.50	103.56	140.17
T_5	75 % RDF + Vermicompost @ 5 t ha^{-1}	339.53	89.19	126.01
T_6	75 % RDF + FYM @ 25 t ha^{-1} + Panchakavya @ 3%	410.01	106.98	149.54
T_7	75 % RDF + Vermicompost @ 5 t ha^{-1} + Panchakavya @ 3%	451.55	143.96	178.01
T_8	75 % RDF + FYM @ 25 t ha^{-1} + Humic acid @ 0.2%	410.61	127.48	174.13
T_9	75 % RDF + Vermicompost @ 5 t ha^{-1} + Humic acid @ 0.2%	493.50	164.48	193.27
T_{10}	- 75 % RDF + FYM @ 25 t ha^{-1} + EM @ 1:1000 dilution	326.37	82.20	119.53
T_{11}	75 % RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 dilution	406.60	105.03	146.15

S. Ed	**0.24**	**0.78**	**1.06**
CD (p = 0.05)	**0.51**	**1.65**	**2.23**

Table.02. Effect of integrated nutrient management on available NPK in soil (kg ha^{-1})

Treatment No.	Treatments	N	P	K
T_1	100 % RDF (125:120:20 kg NPK ha)	105.14	11.23	160.27
T_2	100 % RDF + FYM @ 25 t ha^{-1}	137.88	18.09	177.15
T_3	75 % RDF + FYM @ 25 t ha^{-1}	125.51	15.29	165.21
T_4	100 % RDF + Vermicompost @ 5 t ha^{-1}	188.07	21.65	241.44
T_5	75 % RDF + Vermicompost @ 5 t ha^{-1}	184.34	19.00	206.50
T_6	75 % RDF + FYM @ 25 t ha^{-1} + Panchakavya @ 3%	198.08	22.90	244.62
T_7	75 % RDF + Vermicompost @ 5 t ha^{-1} + Panchakavya @ 3%	207.65	24.70	246.94
T_8	75 % RDF + FYM @ 25 t ha^{-1} + Humic acid @ 0.2%	205.73	24.08	245.05
T_9	75 % RDF + Vermicompost @ 5 t ha^{-1} + Humic acid @ 0.2%	224.28	25.85	247.89
T_{10}	75 % RDF + FYM @ 25 t ha^{-1} + EM @ 1:1000 dilution	195.47	22.09	244.01
T_{11}	75 % RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 dilution	167.78	19.07	184.28
S. Ed		**0.60**	**0.24**	**0.15**
CD (p = 0.05)		**1.28**	**0.51**	**0.33**