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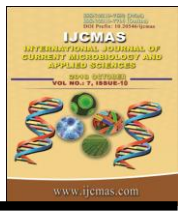

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Studies on the Effect of Integrated Nutrient Management on Growth, Flowering and Yield of Italian Aster (*Aster amellus* L.) cv. 'Purple Multipetal'

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A B S T R A C T

The present investigation "Studies on the effect of integrated nutrient management on growth, flowering and yield of Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'" was carried out at the Floricultural Research Station, (Agricultural Research Institute) Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during September 2017 to January 2018. The experiment was conducted in a Randomized Block Design with three replications and eight treatments. Among all treatments application of RDF 50% + RDF 50% through Vermicompost + Azospirillum + PSB (T_7) was found maximum plant height at 30 (18.36 cm), 60 (32.20 cm), 90 (52.16 cm) and 120 (64.25 cm) DAP, plant spread E-W (17.23, 28.36, 30.52 and 34.30 cm), N-S (14.33, 26.63, 29.46 and 33.4 cm), number of leaves per plant (15.20, 45.06, 81.02 and 198.06) at 30, 60, 90 and 120 DAP respectively and number of suckers per plant (6.33, 10.16 and 15.46) at 60, 90 and 120 DAP respectively. Respect to flowering and yield parameters minimum number of days (69.66 days) taken to flower bud initiation and 50 percent flowering (81.73 days), maximum number of flowers per plant (300.33), number of flowers per spike (181.00) number of spikelets per spike (35.20), number of flower spikes per plant (4.20), number of flower spikes per plot (105.00), number of flower spikes per ha. (4.66 lakhs) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB).

Introduction

Aster malleus L. commonly called as 'Italian aster' or 'daisy' is an upcoming new potential cut flower crop belonging to Asteraceae family. It is a plur annual flower crop grown in many parts of the world for cut flowers. In India, it is being grown for its attractive cut flowers around big cities which are widely used for interior decoration in vases and also for bouquet making. Gradually, it is gaining lot of popularity among consumers and catching the flower markets. The growing popularity of daisy in most of the major cities in India has led to its cultivation as cut flower. The wide spectrum of colour ranges (blues, purples, pinks and whites) available in *Aster amellus* L. Potentially exploited as gardens

plant for colourful effect in herbaceous borders, bedding and pots in gardens and also as dried flowers for interior decoration and export.Integrated nutrient management play an important role for improving the soil structure, physico-chemical properties and flower yield. At present, these nutrients are supplied through chemical fertilizers. The indiscriminate and 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 use of organic manures and bio fertilizers along with the balance use of chemical fertilizers is known to improve physico-chemical and biological properties of soil, besides improving the efficiency of applied fertilizers as well as crop yield and quality.Keeping in view the need and importance, present investigation was undertaken tostudies on the effect of integrated nutrient management on growth, flowering and yield of Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'

Materials and Methods

The present investigation was carried out at Floricultural Research Station, ARI (Agricultural Research Institute) Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during September 2017 to January 2018. The experiment was conducted in a Randomized Block Design with three replications and eight treatments *viz.*,T_1 (100% RDF), T_2 (RDF 50%+RDF 50% through VC), T_3 (RDF 50% +RDF 50% through VC + Azo), T_4 (RDF 50%+ RDF 50% through VC + PSB), T_5 (RDF 50% + RDF 50% through FYM), T_6 (RDF 50% + RDF 50% through FYM + PSB), T_7 (RDF 50% + RDF 50% through VC + Azo + PSB), T_8 (RDF 50% + RDF 50% through FYM + Azo + PSB).The observations on various parameters of vegetative and flowering were recorded at 30, 60, 90 and 120 days after planting.

Observation on growth parameters

Plant height (cm)

The height of the five randomly selected tagged plants was measured from the ground level to the tip of tallest branch of the plant and the average was worked out and expressed in centimeters.

Plant spread (cm)

The maximum horizontal spread of the plant was measured in centimetres.

i.e. N-S and E-W directions at each growth stage.

Number of leaves per plant (No.)

The total numbers of leaves produced in each plant at different growth stages were counted and average was worked out.

Number of suckers per plant (No.)

The number of suckers produced by each tagged plant was counted and their mean was calculated

Observations on flowering and flower yield attribute

Number of days taken to flower initiation

The number of days taken for commencement of flowering was recorded by counting the days from the date of planting to the date of appearance of first flower bud was counted as days taken to flower initiation.

Days to 50 per cent flowering

The number of days taken for 50 per cent of the plants to produce first flower in each plot was recorded by counting the days from the date of planting.

Number of flowers per plant

Number of flowers from each harvest was counted till the final harvest from the selected plants. The average number of flowers per plant was worked out

Number of flowers per spike

Number of flowers produced in each spike was counted from the tagged plants and the average number of flowers per spike was worked out.

Number of flower spikes per plant

Number of flower spikes produced in each plant was counted from the tagged plants and the average number of flower spikes per plant was worked out.

Number of spikelets per spike

Number of spikelets produced in each main flower spike of the observation plants was counted and number of spikelets per flower spike was worked out.

Spike yield per plot (spike no. /plot)

Numbers of flower spike produced by the each plot were recorded at each harvest and the mean value was worked out.

Spike yield per ha (spike no. / ha)

This was worked out by totaling the number of flower spikes per hectare (in lakhs) recorded at each harvest from net plots.

Results and Discussion

The plant height differed significantly due to imposition of integrated nutrient management at all the growth stages. The maximum plant height (18.36 cm) at 30 days after planting (DAP) was recorded in T_7 (RDF 50 % + RDF 50 % through VC + Azo + PSB) it was on par with T_8RDF 50 % + RDF 50 % through FYM + Azo + PSB (17.43 cm). At 60 DAP, significantly the maximum plant height (32.20 cm) was recorded in T_7 followed by T_8 RDF 50 % + RDF 50 % through FYM + Azo + PSB (29.72 cm). At 90 and 120 DAP highest plant height (52.16 and 64.25 cm) was recorded in T_7 respectively. While, the lowest plant height was recorded in T_5 RDF 50 % + RDF 50 % through FYM (Table 2).

The maximum plant spread E-W (17.23, 28.36, 30.52 and 34.30 cm), N-S (14.33, 26.63, 29.46 and 33.4 cm) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB) at 30, 60, 90 and 120 DAP respectively. Minimum plant spread E-W (9.33, 18.60, 19.43 and 24.13 cm), N-S (8.50, 19.40, 22.53, and 27.50 cm) was recorded in T_5 RDF 50 % + RDF 50 % through FYM at 30, 60, 90 and 120 DAP respectively (Table 2).

Maximum number of leaves per plant (15.20, 45.06, 81.02 and 198.06) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB) at 30, 60, 90 and 120 DAP respectively. Minimum number of leaves per plant (10.53, 45.06, 81.20 and 198.06) was recorded in T_5 (RDF 50 % + RDF 50 % through FYM) at 30, 60, 90 and 120 DAP respectively (Table 1).

Maximum number of suckers per plant (6.33, 10.16 and 15.46) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB) at 60, 90 and 120 DAP respectively. At 60 and 90 DAP the minimum number of suckers per plant (1.16 and 6.50) was recorded in T_5 (RDF 50 % + RDF 50 % through FYM), which was on par with T_2 (RDF 50 %+RDF 50 % through VC). At 120 DAP the minimum number of suckers per plant (10.06) was recorded in T_5 (RDF 50 % + RDF 50 % through FYM) (Table 2).

Combined application of inorganic, organic and biofertilizers enhances the plant height, plant spread, number of leaves per plant and number suckers per plant. *Azospirillum* fixes the atmospheric nitrogen and PSB mobilize phosphorous making these elements available for plant growth and development. *Azospirillum* secretes certain growth promoting substances like auxin, gibberellins, vitamins and organic acids which improve the growth. Whereas, PSB has ability to fix higher dose of phosphorous which stimulate root growth and enhances the absorption of nutrients and continuous supply and uptake of nutrients with higher moisture content thus resulting vigorous growth and enhances the number suckers per plant (Swati *et al.*, 2017). Similar results were recorded by Yathindra *et al.*, (2016) in Bird of paradise and Palagani *et al.*, (2013) in chrysanthemum.

Table.1 Number of leaves per plant as influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal' at different stages of growth

Treatments	No. of leaves per plant			
	30 DAP	60 DAP	90 DAP	120 DAP
T_1=100% RDF	13.40	38.4	70.66	175.8
T_2=RDF 50%+RDF 50% through VC	11.86	33.6	60.8	160.26
T_3=RDF 50% +RDF 50% through VC + Azo	12.46	35.13	65.06	168.06
T_4=RDF 50%+ RDF 50% through VC + PSB	13.13	36.46	68.26	170.53
T_5=RDF 50% + RDF 50% through FYM	10.53	30.8	58.93	151.6
T_6 =RDF 50% + RDF 50% through FYM + PSB	12.76	34.26	63.93	165.26
T_7= RDF 50% + RDF 50% through VC + Azo + PSB	15.20	45.06	81.20	198.06
T_8 = RDF 50% + RDF 50% through FYM + Azo + PSB	14.26	40.8	75.33	180.2
Mean	12.95	36.81	68.02	171.22
S.Em ±	0.34	0.48	0.58	0.58
CD at 5%	1.04	1.47	1.77	1.76

Where,
DAP: Days after planting
Azo: *Azospirillum* sp.
PSB: Phosphate solubilizing bacterium
RDF: Recommended dose of Fertilizers.
FYM: Farm Yard Manure
VC: Vermicompost

Table.2 Plant height (cm), plant spread (cm) E-W, plant spread (cm) N-S and No. of suckers per plantas influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal' at different stages of growth

Treatments	Plant height (cm)				Plant spread (cm) E-W				Plant spread (cm) N-S				No. of suckers per plant		
	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP	60 DAP	90 DAP	120 DAP
T_1=100% RDF	16.63	27.31	44.79	56.58	14.16	25.23	26.76	31.03	13.23	26.06	27.70	32.66	3.86	8.50	13.23
T_2=RDF 50%+RDF 50% through VC	14.83	20.33	29.47	42.08	10.33	20.30	22.10	25.06	9.50	21.13	24.36	28.36	1.10	7.13	10.70
T_3=RDF 50% +RDF 50% through VC + Azo	15.46	23.43	34.73	48.00	11.01	21.40	23.23	26.40	10.16	22.40	25.10	29.50	1.36	7.60	11.80
T_4=RDF 50%+ RDF 50% through VC + PSB	16.33	25.76	40.30	54.33	12.16	24.10	26.30	29.20	11.13	24.93	27.16	31.30	3.26	8.66	12.80
T_5=RDF 50% + RDF 50% through FYM	13.43	17.46	28.25	37.33	9.33	18.60	19.43	24.13	8.50	19.40	22.53	27.50	1.16	6.50	10.06
T_6 =RDF 50% + RDF 50% through FYM + PSB	16.20	23.00	38.16	50.33	12.01	23.16	25.45	27.80	11.01	24.03	26.30	30.86	2.20	8.40	12.56
T_7= RDF 50% + RDF 50% through VC + Azo + PSB	18.36	32.20	52.16	64.25	17.23	28.36	30.52	34.30	16.23	29.20	31.33	36.43	6.33	10.16	15.46
T_8 = RDF 50% + RDF 50% through FYM + Azo + PSB	17.43	29.72	47.16	58.36	15.16	26.13	28.37	32.45	14.33	26.63	29.46	33.40	4.53	9.60	14.36
Mean	16.08	24.90	39.38	51.41	12.67	23.41	25.27	28.79	11.76	24.22	26.74	31.25	2.97	8.32	12.62
S.Em ±	0.34	0.75	0.40	1.50	0.57	0.68	0.53	0.47	0.55	0.65	0.57	0.63	0.36	0.35	0.33
CD at 5%	1.02	2.27	1.20	4.54	1.72	2.07	1.60	1.43	1.69	1.97	1.73	1.92	1.09	1.08	1.02

Table.3 Flowering and yield parameters as influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'

Treatments	Days taken to flower bud initiation	Days taken to 50 percent flowering	Number of flowers per plant	Number of flowers per spike	Number of spikelets per spike	Number of flower spikes per plant	Number of flower spikes per plot	Spike no. per ha. (in lakhs)
T_1=100% RDF	74.8	86.83	267.86	153.33	30.33	3.90	97.50	4.33
T_2=RDF 50%+RDF 50% through VC	81.66	93.66	194.86	114.66	25.26	2.26	56.66	2.69
T_3=RDF 50% +RDF 50% through VC + Azo	79.73	91.90	241.46	117.00	28.23	2.43	60.83	2.73
T_4=RDF 50%+ RDF 50% through VC + PSB	75.73	87.73	252.2	130.01	28.20	3.20	80.00	3.55
T_5=RDF 50% + RDF 50% through FYM	82.86	94.90	185.86	104.33	24.06	2.06	51.66	2.29
T_6 =RDF 50% + RDF 50% through FYM + PSB	76.93	88.86	251.8	121.66	28.16	3.03	75.83	3.36
T_7= RDF 50% + RDF 50% through VC + Azo + PSB	69.66	81.73	30.33	181.00	35.20	4.20	105.00	4.66
T_8 = RDF 50% + RDF 50% through FYM + Azo + PSB	72.73	84.83	284.33	164.00	32.90	4.06	101.66	4.51
Mean	76.76	88.80	247.34	135.75	29.04	3.14	78.64	3.51
S.Em ±	0.50	0.48	1.63	5.30	0.52	0.02	0.69	0.08
CD at 5%	1.51	1.46	4.93	16.00	1.57	0.08	2.09	0.25

Where, DAP: Days after planting, FYM: Farm Yard Manure, Azo: *Azospirillum* sp., PSB: Phosphate solubilizing bacterium, RDF: Recommended dose of Fertilizers, VC: Vermicompost

Significant variations were observed among different combinations of inorganic, organic and bio fertilizers application with respect to floral parameters, minimum number of days (69.66 days) taken to flower bud initiation and 50 per cent flowering (81.73 days) and Maximum number of flowers per plant (300.33), number of flowers per spike (181.00) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB). Maximum number of days (82.86 days) taken to flower bud initiation and 50 per cent flowering (94.90 days) and minimum number of flowers per plant (185.86), number of flowers per spike (104.33)was recorded in T_5 (RDF 50 % + RDF 50 % through FYM).

Maximum number of spikelets per spike (35.20), number of flower spikes per plant (4.20), number of flower spikes per plot (105.00), number of flower spikes per ha. (4.66 lakhs) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB). While, minimum number of spikelets per spike (24.06), number of flower spikes per plant (2.06), number of flower spikes per plot (51.66), number of flower spikes per ha. (2.29 lakhs) was recorded in T_5 (RDF 50 % + RDF 50 % through FYM) (Table 3).

The increase in number of flower spikes might be due to possible role of *Azospirillum* through atmospheric nitrogen fixation, better root proliferation, uptake of nutrients and water. More photosynthesis enhanced food accumulation which might have resulted in better growth and subsequently higher number of flower spikes per plant and hence, more number of flower yield per hectare. Besides this, increase in flower spike yield may be attributed to increased availability of phosphorus and its greater uptake by PSB (Kundu and Gaur, 1980). Further vermicompost, as the source of macro and micro nutrients like Fe and Zn, enzymes, growth hormones and beneficial effects of micro flora might have played a secondary role in increasing the flower spike yield. These results are in line with the findings Akter *et al.,* (2017) in gladiolus, Sunita Kumari and VM Prasad (2017) in petunia, Swati *et al.,* (2017) in golden rod and Ghisewad *et al.,* (2016) in gladiolus.

On the basis of results obtained in the present investigation, it can be concluded that the application inorganic fertilizers, organic manures along with inoculation of Azospirillum and PSB results in higher flower yield in Italian aster. Therefore application of RDF 50 % through inorganic + 50 % through VC + Azo + PSB (T_7) recorded better plant growth, flowering and higher yield in Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'.

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