International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(1): 1185-1188

Received: 06-11-2018
Accepted: 10-12-2018

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Impact of integrated nutrient management on post harvest vase life of Italian aster (*Aster amellus* L.) cv. 'purple multipetal

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Abstract
The present investigation"Impact of integrated nutrient management on postharvest vase life 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 fresh weight of the spike (90.71 g), vase life (8.03 days) transpirational loss of water (13.52, 11.26, 9.33 and 8.23 g/spike) was recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB) at 2nd day, 4th day, 6th day and 8th day respectively. Minimum fresh weight change (%) also recorded in T_7 (RDF 50% + RDF 50% through VC + Azo + PSB).

Keywords: italian aster, INM, RDF, vermicompost, FYM, azospirillum, PSB, vase life, TLW and FWC

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 to impact of integrated nutrient management on postharvest vase of Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal' (Siddappa, 2017) [8].

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).

After harvesting the flower spikes placed in 3 per cent sucrose solution. To collect the data, flasks with solution and with or without flowers were weighed on every alternate day and with these weighs, Transpirational loss water and fresh weight change were worked out.

1. Fresh weight of spike (g)
Fresh weight of the spike is taken before spikes keeping in the vase solution.

2. Fresh weight change of spike (FWC)
The difference between the weight of the container + solution + flower stalk and weight of the container + solution decreased at every alternate day represents the fresh weight of the spikes in grams on that particular day. The fresh weight gain or loss is converted into percentage considering the first day's fresh weight as 100 per cent. (Venkatarayappa *et al.*, 1980) [10].

3. Transpiration loss of water (TLW)
Flasks were weighed daily along with solution and spikes and the consecutive difference in weights represents the water loss from the spikes for that particular period and expressed in grams per stalks. (Venkatarayappa *et al*., 1980) [10].

$$TLW = \frac{\text{Intial wt. of container With flower} - \text{Final wt. of container with flower}}{\text{No. of flower spike in the bottle}}$$

4. Vase life
The point of termination of vase life varied from the wilting of flowers. Flower spikes were discarded when 50 per cent of florets wilted. This stage was considered to be the end of potential useful longevity of daisy flower spikes and the number of days taken for this was recorded daily observation of flower spikes they were found unfit for continuing in the vase.

Results and Discussion
1. Fresh weight (FW) of spike (g)
The maximum fresh weight of spike (90.71 g) was recorded in T_7 (RDF 50 % + RDF 50 % through VC + Azo + PSB) and it was significantly followed by T_8 RDF 50 % + RDF 50 % through FYM + Azo + PSB(85.25 g). Whereas, the minimum fresh weight of spike (60.60 g) was observed in T_5 (RDF 50 % + RDF 50 % through FYM) and it was on par with T_2 (RDF 50 %+RDF 50 % through VC). Remaining other treatments showed intermediate results.
Fresh weight of the spike increased due to biological fixation of nitrogen and phosphorus in root portion of plants resulting in absorption of more nutrients and its utilization. Moreover, Azospirillum has a role in nitrogen fixation and is also involved in the production of IAA, GA and Cytokinin like substances which enhance the growth of plants. These findings are in accordance with the results of Rajesh *et al.* (2006) [5] who stated that application of bio fertilizers like Azotobacter/ Azospirillum, Phosphate solubilizing bacterium enhanced the flower fresh weight in carnation and Harish *et al. (*2015) in gladiolus.

2. Transpirational loss of water (g/spike)
The cut Italian aster spikes held in three per cent sucrose solution treatments differed significantly on TLW. Highest TLW (10.58 g) was recorded in RDF 50 % + RDF 50 % through VC + Azo + PSB (T_7) while the lowest TLW (7.70 g) was recorded in RDF 50 %+RDF 50 % through VC (T_2).
There were significant differences in TLW during different days of vase life period. The TLW decreased from day 2 (10.90) to day 8 (6.41g) with significant difference at each successive interval of observation.
The interaction effect on TLW between days and treatments was significant. Highest TLW was recorded in RDF 50 % + RDF 50 % through VC + Azo + PSB (T_7) on day 2nd, 4th, 6th and 8th (13.52, 11.26, 9.33 and 8.23 respectively). However, on 2nd day minimum TLW (9.22) was recorded in RDF 50 % + RDF 50 % through FYM (T_5) and on day 4th, 6th and 8th minimum TLW (8.14, 6.21 and 5.14 respectively) was recorded in 100 % RDF (T_1) Remaining other treatments showed intermediate results.
Higher TLW by spike might be due to higher water uptake to avoid temporary water stress and thus led to increase the membrane viscosity. The quantity of water retained in the flowers was meager which led to wilting of cut flowers. Azospirillum has a role in nitrogen fixation and is also involved in the production of IAA, GA and Cytokinin like substances which enhance the metabolic activity of the cells and leads to higher TLW. The present results were in accordance with the findings of Rekha *et al.* (2001) [6] in cut gladiolus spike, Tang *et al.* (2004) [1] in cut gerbera and Harish *et al. (*2015) in gladiolus

3. Fresh weight change (FWC % of initial weight)
Fresh weight increased from the first day of experimentation, reached a peak on 2nd day, followed by a gradual decrease thereafter. Fresh weight significantly increased (100.00) from 1st day of experimentation, reached a peak on 2nd day (105.05) and gradually decreased till the end of vase life period.
The treatments differed significantly on FWC, highest FW (100.68) was recorded in RDF 50 % + RDF 50 % through VC + Azo + PSB (T_7) while the lowest FW (91.64) was recorded in 100 % RDF (T_1).
There were significant differences in FWC during different days of vase life period. The FW increased from 1st day (100.00) to 2nd day (103.11) significantly and then decreased from day 4th (100.44) to day 8th (89.70) with significant difference at each successive interval of observation.
The interaction effect on FWC between days and treatments was significant. Maximum FW was recorded in RDF 50 % + RDF 50 % through VC + Azo + PSB (T_7) on day 2nd, 4th, 6th and 8th (105.05, 103.42, 99.82 and 94.39 respectively). However, on 2nd day minimum FW (101.51) recorded in RDF 50 % + RDF 50 % through FYM (T_5) and on day 4th, 6th and 8th minimum FW (93.42, 86.41 and 82.52 respectively) recorded in 100 % RDF (T_1).
In addition, humic acid and micronutrients of vermicompost had greater influence in stimulating and regulating metabolism, speeding up the developmental process of plant which, in turn, resulted in fresh change in spike during the vase life. These findings are in line with the results reported by Angadi and Airadevi (2014) [2] in chrysanthemum, Harish *et al. (*2015) in gladiolus and Shivaraj Kumar (2010) [7] in chrysanthemum.

4. Vase life (days)
Vase life (days) is significantly affected by integrated nutrient management during vase life period of Italian aster. (Table 4.)
The maximum vase life (8.03 days) was recorded in T_7 (RDF 50 % + RDF 50 % through VC + Azo + PSB) and it was significantly followed by T_4 RDF 50 %+ RDF 50 % through

VC + PSB (7.06 days). Whereas, the minimum days (6.03 days) was observed in T_1 (100 % RDF). Remaining other treatments (T_4, T_3, T_8, T_6, T_2 and T_5) were on par with each other. Which might be due to the higher retention of water in the cells of flowers and lower desiccation. Similar beneficial effects of bio fertilizers and vermicompost on shelf life have been reported in chrysanthemum by Shivaraj Kumar., 2010) [7], Anand *et al.* (2016) [1] in orchid, Angadi and Airadevi (2014) [2] in chrysanthemum and Harish *et al. (*2015) in gladiolus.

Conclusion

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 maximum fresh weight of the spike, vase life and transpirational loss of water in Italian aster. Therefore application of RDF 50 % through inorganic + 50 % through VC + Azo + PSB (T_7) recorded maximum fresh weight of the spike, vase life and transpirational loss of water in Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'.

Table 1: Fresh weight of the spike and vase life as influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'.

Treatments	Fresh weight of the spike (g)	Vase life (Days)
T_1=100% RDF	78.78	6.03
T_2=RDF 50%+RDF 50% through VC	64.33	6.26
T_3=RDF 50% +RDF 50% through VC + Azo	68.29	6.73
T_4=RDF 50%+ RDF 50% through VC + PSB	76.40	7.06
T_5=RDF 50% + RDF 50% through FYM	60.60	6.18
T_6 =RDF 50% + RDF 50% through FYM + PSB	72.30	6.36
T_7= RDF 50% + RDF 50% through VC + Azo + PSB	90.71	8.03
T_8 = RDF 50% + RDF 50% through FYM + Azo + PSB	85.25	6.40
Mean	74.58	6.63
S.Em ±	1.32	0.17
CD at 5%	3.99	0.51

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

Table 2: Transpirational loss of water (TLW) (g/spike) during vase life period as influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'.

Treatments	Days (D)				Treatments mean
	2	4	6	8	
T_1=100% RDF	12.33	8.14	6.21	5.14	7.95
T_2=RDF 50%+RDF 50% through V.C	9.52	8.73	6.83	5.73	7.70
T_3=RDF 50% +RDF 50% through V.C + Azo	10.83	9.92	7.02	6.93	8.68
T_4=RDF 50%+ RDF 50% through V.C + P.S.B	11.54	10.62	8.74	7.64	9.63
T_5=RDF 50% + RDF 50% through FYM	9.22	8.33	6.43	5.35	7.33
T_6 =RDF 50% + RDF 50% through FYM + P.S.B	9.93	8.82	6.93	5.86	7.89
T_7= RDF 50% + RDF 50% through V.C + Azo + P.S.B	13.52	11.26	9.33	8.23	10.58
T_8 = RDF 50% + RDF 50% through FYM + Azo + P.S.B	10.33	9.43	7.57	6.43	8.44
Days mean	10.90	9.41	7.38	6.41	
SEM ±	CD (P = 0.05)				
Treatments (T)	0.006			0.01	
Days (D)	0.004			0.01	
T × D	0.01			0.03	

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

Table 3: Fresh weight change (% of initial weight) during vase life period as influenced by INM on Italian aster (*Aster amellus* L.) cv. 'Purple Multipetal'

Treatments	Days (D)				Treatments mean
	2	4	6	8	
T_1=100% RDF	104.20	93.42	86.41	82.52	91.64
T_2=RDF 50%+RDF 50% through V.C	101.91	100.31	92.43	88.34	95.75
T_3=RDF 50% +RDF 50% through V.C + Azo	103.08	101.92	96.12	92.90	98.50
T_4=RDF 50%+ RDF 50% through V.C + P.S.B	103.70	102.61	97.33	93.12	99.19
T_5=RDF 50% + RDF 50% through FYM	101.51	100.21	91.56	86.74	95.00
T_6 =RDF 50% + RDF 50% through FYM + P.S.B	102.60	100.65	93.31	89.42	96.49
T_7= RDF 50% + RDF 50% through V.C + Azo + P.S.B	105.05	103.42	99.89	94.39	100.68
T_8 = RDF 50% + RDF 50% through FYM + Azo + P.S.B	102.80	100.97	94.76	90.21	97.18

Days mean	103.11	100.44	93.97	89.70	
SEM ± CD (P = 0.05)					
Treatments (T) 0.02 0.06					
Days (D) 0.01 0.04					
T × D 0.04 0.13					

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

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