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Evaluation of Spraying Amino Acids on Growth, Flowering and Chemical Constituents of Monte Casino Aster

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Abstract: The effect of aminomore (Amino acid complex 15.78%) on growth and flowering of Aster ericoides was investigated during 2016 and 2017 seasons. Five treatments were sprayed (control, 75, 150, 225 and 300 ppm). The effects were evaluated on vegetative growth parameter, roots characters, flowering and chemical constituents. Highest values of vegetative growth parameter of Monte Casino aster pants were obtained with spraying aminomore at 225 ppm. On contrary, no significant effects to aminomore spraying on number of internodes/ main stem. A great effect on average roots length was recorded by spraying 150 and 225 ppm. Whereas highest values of average roots number and root fresh & dry weights were recorded by spraying aminomore at 225 ppm .Regarding flowering, a slight effect to aminomore spraying on number of flowering branches/ plant was only found with 75 ppm. On the other hand, highest values of number of flowers per branches, total number of flowers per plant and flower diameter were recorded with 225 ppm. Post harvest flower life reached to 7 days with 225 ppm compared to 4.7 days for control. The highest values of chemical constituents were obtained with 225 and 300 ppm aminomore spraying It could be extracted that spraying of aminomore amino acids at 225 or 300 ppm twice at first July and again on 15th of July on Monte Casino aster plants greatly improved flowering and vase life of flowers.

Key words: Aster ericoides · Monte Casino · Amino acids · Aminomore · Flowering · Flower Vase life

INTRODUCTION

Aster is an individual plant from the Asteraceae family and is a local to Eastern North America. Aster is the Latin type of the Greek "Astron" which means star. Aster group contains more than 600 types of semi-wood herbaceous perennials and contains 3-4 species valuable as cut blooms. It positions by chrysanthemum and marigold among the customary flowers. The fundamental species utilized are Aster ericoides and the primary assortment utilized in this investigation is Monte Casino which is otherwise called the Heath Aster or September blossom Aster, their blooms are white and the plants are assembled by development propensity as perennials plants. It is generally found as a little filler bloom in courses of action on an all year premise and is a typical pick among flower specialists [1, 2]. Through old social orders the aster blossom has come to be known as an image of appeal and persistence just as refinement and style. The antiquated likewise accept that, by mooching aster leaves they could drive away snakes with the smell just as be utilized as affection engage. The blossoms offer a special wonder that has additionally offered some therapeutic successes [3, 4].

The job of amino component i.e.(tryptophan) in animating the development and actuating plants were considered by Phillips [5] who expressed that few elective jobs of IAA union exist in plants all beginning from amino acids additionally work in the amalgamation of other natural compound, for example, protein, amines, purine and primidines, alkaloids, catalysts, terpenoids and others [6]. The useful impact of amino acids on new cell creation through reestablishing the particular compounds for protein union has been expressed by Levitt [7]. Amino acids are natural synthetic mixes and are the pudding squares of protein, which perform basic, metabolic and transport works in plants [8]. Amino acids are the forerunners of phytohormones and other development

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substances. Amino acids improve the effectiveness of the plant's digestion to initiate blossoming increments and upgrade quality, encouraging supplement absorption and translocation [9]. A positive job of some amino acids in animating development and some compound parts was accounted by Talaat *et al.* [10].

Amino acids are especially significant for invigorating cell development. They go about as cradles which help to keep up a good pH esteem inside the plant cell, since they contain both corrosive and essential gatherings and they expel the alkali from the phone. This capacity is related with amide development, so they shield the lant from smelling salts danger. Amino acids additionally repress plant nitrate take-up [11]. They can fill in as a wellspring of carbon and vitality too and ensure the plant against pathogens. Amino acids have a capacity in the combination of amines, purines and pyrimidines, alkaloids, nutrients, chemicals, terpenoides and others [6]. Amino acids are notable bio stimulant which affect plant development, yield and altogether mitigates the wounds brought about by abiotic stresses [12]. They can likewise go about as parts of co-proteins or as forerunners of certain plant hormones and improve plant development by means of improving photosynthesis [13, 14].

The principle focus of this investigation is to assess various doses of amino acids blend (named aminomore and contained 15.78 % amino acids) on development, blossoming qualities and chemical constituents of Monte Casino perennials (Aster ericoides).

MATERIALS AND METHODS

This study was conducted during 2016 and 2017 seasons on perennials Aster ericoides var. Monte Casino plants which produced white flowers, seedlings similar in vigoums were transplanted on 15th of March 2016 and 2017 seasons in 25 diameter pot , filled with peat moss and sand 1:1 in the Ornamental Nursery, Faculty of Agriculture Ain Shams University Cairo, Egypt.

However on 15th of May of both studied seasons, apical buds were removed by hand (pinching) and all plants adapted at 20 cm in length. All horticulture practices including irrigation, macro and micro nutrients fertilization and pest managements were done as recommended in this respect

Amino acids mixture named Aminomore (contained 15.78% concentration of total amino acids) was sprayed twice in first July and again on the same plants on 15th of July in both studied seasons. Five treatments were sprayed as followed:

Control was sprayed with tap water; foliar spraying with 75 ppm of aminomore (0.5 cm^3/liter); foliar spraying with 150 ppm of aminomore (1.0 cm^3/liter); foliar spraying with 225 ppm of aminomore (1.5 cm^3/liter) and foliar spraying with 300 ppm of aminomore (2.0 cm^3/liter).

The experiment was arranged in a randomized complete block design (RCBD) with 4 replicates for each treatment, each replicate contained 5 plants. (5 treatments x 4 replicates x 5 plants = 100 plants)

Data Recorded

Vegetative Growth Parameters: Plant height (cm), offshoots number/plant, internodes length (cm) and thickness of main stem (cm) were measured four times first of August, 15th of August, first of Sep. and 15th of Sep. in each seasons and percent of increase was calculated.

Fresh weight, dry weight of vegetative growth (g/plant) and number of internodes/ main stem were determined at 15th of September in each season.

Roots Characteristics: Average root length (cm), average root number /plant, fresh and dry weights of roots were recorded at 15th of September in each season.

Flowering Traits: Number of flowering braches /plant, number of flowers per branch, total number of flowers/plant, flower diameter (cm) were measured when 50 % of flower buds were opened and continue till 15th of Sep.

Post harvest flower life (Vase life) was determined for each treatment, flowers were harvested between 7:00 am and 10:00 am at the optimum stage of development (nearly first of September for each season). The lower half of the stem was stripped of its leaves and then placed into vases as ten flowers per replicate, vases were filled with tap water and kept on shelves in the lab at room temperature. Flowers were discarded daily until reaching 50% of their number based on petal wilt, turning brown or stem bent and the number of days were calculated.

Chemical Constituents: Total carbohydrates (g/ 100 g dry weight) in dry sample of vegetative growth was determined according to Dubois *et al*. [15].

Total nitrogen (g/ 100 g dry weight) was determined in dry samples of vegetative growth according to FAO [16].

C/N ratio was calculated by dividing total carbohydrates by total nitrogen.

Total chlorophyll was determined by Minalta chlorophyll meter reading.

Statistical Analysis: Data of results were statistically analyzed using analysis of variance (ANOVA) described by Snedecor and Cochran[17]. The method of Duncan multiple range tests was applied for the comparison between means according to Waller and Duncan [18].

RESULTS AND DISCUSSION

Effect of Spraying Aminomore Component (Amino Acids Mixture) on Vegetative Growth Parameter of Aster Ericoides Var. Monte Casino Plants:

Plant Height (cm): It is clear from data in Table (1) for both studied seasons that all used concentrations of aminomore as a source of amino acids greatly increased plant height of Monte Casino Aster plants than control in all sampling dates. Significant effects were recorded by 225 ppm concentration followed by 75 and 300 ppm whereas150 ppm came later. Percentage of plant height increasing data showed that 225 ppm recorded 64.7 and 78.7% in first and second season respectively compared with 42.9 and 47.5 for control. The same trend of results was recorded for the two studied seasons.

Number of Offshoots /Plant: Data tabulated in Table (2) declare that spraying amino acid component on Monte Casino Aster plant greatly increased the production of off-shoots than unsprayed plants. However the concentrations of 225 ppm was superior than other concentrations in the hastening of off-shoots production in all sampling dates the highest percentage in this respect was recoded by spraying 225 ppm (85.7 and 100%) for the two studied seasons respectively. Unsprayed plants were less in producing off-shoots (42.9and 47.5%) for both seasons. It is well known that Monte Casino Aster plant is a hardy herbaceous perennials plants and increasing of off-shoots production is a good economies character.

Internodes Length (cm): Data tabulated in Table (3) show the effect of different concentrations spraying of aminomore compound as a source of amino acids complex on internodes length of Aster ericoides var. Monte Casino plants during 2016 and 2017 seasons. There was an evident increase in internodes length with all amino acids concentrations used than control. However 225 ppm of amino acids was superior than other concentrations in this respect. Average increase in internodes length ranged from 51.1 to 72.5% with amino acid treatments compared with 37.5% for control at the end of growth cycle (mid of September) Moreover 75 and 150 ppm of amino acid were similar in their effect on internode length without significant differences between them in both seasons . On the other hand, 225 and 300 ppm were similar in their effect and superior than 75 and 150 ppm.

Thickness of Main Stem (cm): It is clear from data tabulated in Table (4) that all used concentrations of aminomore compound as a source of amino acids complex greatly increased thickness of main stem of Aster ericoides var. Monte Casino plants than control in both studied seasons. The highest values of main stem thickness of Monte Casino aster plant were obtained with 225 ppm of amino acid spraying in both studied seasons. Increasing of main stem is a good indicator for growth and flowering in Aster plants. However, the other concentrations were nearly similar in their effect on the development of main stem thickness. Percentage of increased in main stem thickness in Monte Casino Aster plants was 26.6 and 30.8 % for 225 ppm amino acid spraying compared with 16.1 and 14.8% only for control in first and second seasons, respectively.

Vegetative Fresh and Dry Weights (g/Plant) and Number of Internodes/ Main Stem: It is clear from data in Table (5) that spraying of aminomore compound at 75, 150, 225 and 300 ppm on Aster ericoides Var Monte Casino plants greatly affected fresh and dry weights whereas no significant effects was obtained on number of internodes per main stem during 2016 and 2017 seasons . The high values of plant fresh weights (59.1 and 44.37g) were obtained for 225 ppm of aminomore during first and second seasons, respectively, whereas control plants, recorded the least values (38.5 and 31.16g)in both seasons. No significant effects between 75 and 150 ppm in first season and between 150 and 300 ppm in second season in affecting plant fresh weight were obtained.

Additionally, highest values of plant dry weights (19.06 and 19.50g) were recorded by 225 ppm of aminomore in both seasons. However 75 and 150 ppm of aminomore were similar in their effect on plant dry weight in both studied seasons. Number of internodes did not significantly affect with spraying of aminomore in all concentrations. Average number of internodes ranged from 19 to 23 internodes per plant regardless of the used aminomore concentration.

The great effect to amino acid in stimulating the growth and activating plants are similar to those found by Phillips [5]. They improve the efficiency of the plant's metabolism to induce flowering increases and enhance quality [9]. However, Talaat *et al.* [10] reported

Table 1: Effect of different concentrations of aminomore (amino acid mixture) spraying on plant height (cm) of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

	Sampling date				
Aminomore concentration	1 August	15 August	1 Sept.	15 Sept.	% of increase
			First Season		
Control	27.0 b	30.7 d	34.1 d	38.5 d	42.9
75 ppm	31.8 a	41.5 b	44.3 b	48.2 b	51.6
150 ppm	30.8 a	37.5 c	41.2 c	47.0 c	52.6
225 ppm	32.5 a	44.3 a	49.8 a	53.5 a	64.7
300 ppm	31.0 a	40.4 b	46.1 b	49.1 b	58.4
			Second Season		
Control	17.73 c	20.1 c	23.8 c	26.1 c	47.5
75 ppm	21.5 ab	22.4 b	25.5 c	33.6 b	56.3
150 ppm	22.2 ab	24.2 b	30.2 b	35.1 b	59.5
225 ppm	23.75 a	31.4 a	38.4 a	42.5 a	78.7
300 ppm	19.79 c	23.0 b	29.4 b	33.1 b	67.1

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level.

Table 2: Effect of different concentrations of aminomore (amino acid mixture) spraying on number of offshoots /plant of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

	Sampling date				
Aminomore concentration	1 August	15 August	1 Sept.	15 Sept.	% of increase
			First Season		
Control	2.0 c	2.25 d	2.5 d	2.5 d	25.0
75 ppm	2.5 c	3.0 c	3.8 c	3.8 c	52.0
150 ppm	3.25 a	4.0 b	4.5 b	5.0 ab	53.8
225 ppm	3.50 a	5.0 a	6.0 a	6.5 a	85.7
300 ppm	3.0 ab	3.8 b	4.0 bc	5.0 ab	66.7
			Second season		
Control	1.75 c	2.0 d	2.25 d	2.25 d	28.5
75 ppm	2.75 b	3.0 c	3.25 c	3.75 c	36.4
150 ppm	3.0 ab	4.0 b	4.0 c	4.5 c	50.0
225 ppm	3.50 a	5.5 a	6.0 a	7.0 a	100.0
300 ppm	3.0 ab	4.25 b	5.00 b	5. 5 b	83.3

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level.

Table 3: Effect of different concentrations of aminomore (amino acid mixture) spraying on internodes length (cm) of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

	Sampling date				
Aminomore concentration	1 August	15 August	1 Sept.	15 Sept.	% of increase
			First Season		
Control	1.28 b	1.64 b	1.73 c	1.76 d	37.5
75 ppm	1.44 a	1.68 b	1.77 c	2.18 bc	51.4
150 ppm	1.39 a	1.75 ab	1.97 b	2.10 c	51.1
225 ppm	1.42 a	1.94 a	2.28 a	2.45 a	72.5
300 ppm	1.38 a	1.88 a	2.03 b	2.27 b	64.5
			Second season		
Control	0.91 c	1.05 d	1.25 d	1.33 d	46.2
75 ppm	1.03 b	1.27 c	1.40 c	1.73 c	67.9
150 ppm	1.07 b	1.39 bc	1.68 b	1.90 bc	77.6
225 ppm	1.20 a	1.87 a	2.02 a	2.28 a	90.0
300 ppm	1.10 ab	1.44 b	1.73 b	2.01 b	82.3

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level.

Table 4: Effect of different concentrations of aminomore (amino acid mixture) spraying on Thickness of main stem (cm) of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

	Sampling date				
Aminomore concentration	1 August	15 August	1 Sept.	15 Sept.	% of increase
			First Season		
Control	0.56 b	0.61 c	0.62 c	0.65 c	16.1
75 ppm	0.62 a	0.69 ab	0.71 b	0.74 b	19.4
150 ppm	0.61 a	0.67 b	0.71 b	0.73 b	19.7
225 ppm	0.64 a	0.73 a	0.77 a	0.81 a	26.6
300 ppm	0.61 a	0.66 b	0.69 b	0.75 b	23.0
			Second season		
Control	0.54 c	0.57 c	0.60 c	0.62 c	14.8
75 ppm	0.61 b	0.63 b	0.67 b	0.71 b	16.3
150 ppm	0.60 b	0.65 ab	0.69 b	0.72 b	20.0
225 ppm	0.65 a	0.70 a	0.76 a	0.85 a	30.8
300 ppm	0.59 b	0.64 b	0.67 b	0.75 b	27.1

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level.

Table 5: Effect of different concentrations of aminomore (amino acid mixture) spraying on fresh & dry weight (g/plant) and number of internodes/ main stem of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

		First Season	
Aminomore concentration	Fresh weight (g)	Dry weight (g)	Number of internodes
Control	38.5 d	12.8 d	21 a
75 ppm	48.6 c	14.73 c	22 a
150 ppm	47.2 c	15.32 bc	21 a
225 ppm	59.1 a	19.06 a	23 a
300 ppm	55.22 b	15.6 bc	21 a
		Second season	
Control	31.16 c	10.28 d	19 a
75 ppm	33.21 c	12.37 c	21 a
150 ppm	37.48 b	12.80 c	22 a
225 ppm	44.37 a	19.50 a	21 a
300 ppm	38.73 b	14.92 b	20 a

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level

that tryptophan amino acid increased plant height, branch number, fresh and dry weights of leaves and increased total chlorophyll in Ornamental plants.

Effect of Spraying Aminomore Component (Amino Acids Mixture) on Roots Characters of Aster Ericoides Var. Monte Casino Plants: Data in Table (6) showed the effect of spraying aminomore at 4 concentrations on average root length (cm), average root number, root fresh and dry weights (g) during 2016 and 2017 seasons.

The highest values of root length were obtained with 150 and 225 ppm of aminomore in both seasons without significant differences between them. However, the highest values of root number per plant were obtained by spraying 225 ppm of aminomore .The highest values of root fresh and dry weight were recorded by 225 ppm followed by 300 ppm. Generally, it could be noticed that spraying aminomore compound greatly improved the root characters compared with control and this findings promote root absorbance for water and nutrients which improved flowering parameters which discussed later.

Effect of Spraying Aminomore Component (Amino Acid Mixture) on Flowering Traits of Aster Ericoides Var. Monte Casino Plants: It is clear from data in Table (7) that flowering traits of Monte Casino Aster plants greatly affected with spraying of different concentrations of amino acid mixture during 2016 and 2017.

Number of flowering branches per plants decreased with amino acid spraying compared to control and the least number were recorded with 225 and 300 ppm without significant differences between them. This finding could be attributed to that amino acid mixture increased vegetative growth against flowering , but this effect positively affected the other flowering characters However, the highest values of flowers per branch and

Table 6: Effect of different concentrations of aminomore (amino acid mixture) spraying on roots characters of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

		First Season		
Aminomore concentration	Root length (cm)	Root number	Fresh weight (g)	Dry weight (g)
Control	25.2 b	35.7 c	11.3 c	4.18 c
75 ppm	25.2 b	35.7 c	11.3 c	4.18 c
150 ppm	34.7 a	45.23 b	15.8 b	6.64 b
225 ppm	30.8 a	61.75 a	19.23 a	7.96 a
300 ppm	29.7 ab	48.0 b	16.7 b	6.85 ab
		Second season		
Control	27.3 b	40.2 c	10.72 c	3.97 c
75 ppm	30.8 ab	36.8 c	15.91 b	5.83 b
150 ppm	30.5 ab	47.8 b	15.73 b	6.12 ab
225 ppm	35.7 a	67.4 a	19.20 a	7.11 a
300 ppm	32.9 a	51.3 b	17.06 ab	6.32 ab

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level

Table 7: Effect of different concentrations of aminomore (amino acid mixture) spraying on flowering traits of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

		First season			
Aminomore concentration	No. of flowering braches /plant	No. of flower per breach	Total No. of flower /plant	Flower diameter (cm)	Vase life days
Control	7.21 a	19.0 c	137.0 d	0.92 c	4.7 d
75 ppm	7.52 a	23.0 c	173.0 c	0.99 c	5.3 c
150 ppm	6.07 b	31.0 b	188.25 b	1.08 b	6.3 b
225 ppm	5.02 c	42.0 a	211.0 a	1.20 a	7.0 a
300 ppm	5.05 c	37.0 a	187.0 b	1.19 a	6.3 a
			Second season		
Control	6.26 a	17.7 d	110.75 d	0.95 c	3.3 d
75 ppm	5.72 ab	21.5 c	123.0 c	1.04 c	4.5 c
150 ppm	5.54 b	25.0 c	138.5 b	1.15 b	5.6 a
225 ppm	4.60 c	36.7 a	168.75 a	1.26 a	5.9 a
300 ppm	4.77c	30.5 b	145.50 b	1.24 a	5.0 b

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level

consequently total number of flowers per plant were obtained with all used concentrations of amino acid mixture. However, the highest significant values were obtained with 225 ppm followed by 300 ppm both number of flower either per branch or per plant. The great and positive effect to amino acid mixture on flowering traits in Monte Casino aster plants attributed mainly to the improvement of vegetative growth and good flowering characterizes.

Flower diameter was increased with all amino acid concentrations especially with 225 and 300 ppm without significant differences between them. Generally, it could be concluded that amino acid mixture aminomore spraying on Monte Casino aster plants was effective in increasing number of flowers either per plant or per branch and also increased flower diameter and consequently produced a flower with good quality and quantity.

Post harvest flower life of Monte Casino aster plants greatly increased with spraying aminomore as a source of amino acid mixture than control. Vase life values recorded 3.3-4.7 days in control against 5.0 to 7.0 days in treated plants. Generally, it could be concluded that Monte Casino aster flower could be used as a cut flower after spraying the plants with aminomore at 225 ppm.

In this respect Saburi *et al.* [19] reported that spraying amino acid (Tryptophan) inhibits the precocious flower and consequently increased flowering density similar to the obtained data. It is well known that increasing of flowers production and quality of flowers in ornamental plants i, e perennials aster are important objectives to be reckoned in commercial flower production. This finding from the obtained data could be achieved by spraying amino acids with the used concentrations [20].

Effect of Spraying Aminomore Component (Amino Acid Mixture) on Chemical Constituents of Aster Ericoides Var. Monte Casino Plants: A great effect to amino acid mixture spraying on Chemical constituents of Monte Casino aster plants during 2016 and 2017 seasons.

Table 8: Effect of different concentrations of aminomore (amino acid mixture) spraying on chemical constituents of Aster ericoides var. Monte Casino during 2016 and 2017 seasons

		First season		
Aminomore concentration	Total carbohydrates	Total nitrogen	C/ N ratio	Total chlorophyll
Control	5.30 d	1.40 bc	3.79 c	31.75 c
75 ppm	6.20 c	1.30 c	4.77 b	37.0 b
150 ppm	6.70 b	1.42 abc	4.72 b	46.6 a
225 ppm	8.20 a	1.60 ab	5.13 a	49.80 a
300 ppm	8.00 a	1.63 a	4.91 b	47.3 a
		Second season		
Control	6.20 c	1.50 b	4.13 d	32.5 d
75 ppm	6.30 c	1.63 ab	3.87 d	41.0 c
150 ppm	8.20 b	1.72 a	4.77 c	45.5 b
225 ppm	10.30 a	1.78 a	5.79 b	53.2 a
300 ppm	10.00 a	1.63 ab	6.13 a	49.3 ab

Values in the same column followed by the same letter (s) are not statistically different according to Duncan's multiple range tests at 5% level

Total carbohydrates recorded highest values (8.0 and 8.20%) in first season and (10.0 and 10.30 %) in second season with 225 and 300 ppm amino more spraying without significant differences between them. the increasing of total carbohydrates was the main factor in improvement of flowering characterates which previously discussed. Total nitrogen greatly affected with amino acid mixture spraying than control and the highest values of nitrogen % were recorded by 300 ppm in first season and 225 ppm in second one . Calculating of C/N ratio (5.13 and 6.13) were obtained with 225 ppm and 300 ppm in first and second season respectively. High values of C/N ratio are related to high quality and quantity flowering of Monte Casino aster plants, so spraying of aminomore was effective in this respect through increasing of C/N ratio.

Total chlorophyll greatly increased with all used concentrations of aminomore than control and the highest values total of chlorophyll were obtained with 225 ppm in both seasons. The increase in total chlorophyll beside high values of C/N ratio considered responsible factors for improvement flowering in Monte Casino aster plants.

The great effect of amino acids on improvement of chemical constituents of treated plants could be attributed to that amino acids can directly or indirectly influence the physiological activities in plant growth and development such as exogenous application of amino acids have been reported to modulate the growth, production and quality in treated plants. The same trend of results on the positive role of amino acids in stimulating growth and flowering traits was also found by Talaat *et al.* [10] who worked on Periwinkle (*Catharanthus roses* L.).

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