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**GROWTH CHARACTERISTICS OF GERMAN CHAMOMILE AS AFFECTED BY
SPERMIDINE AND NAPHTHALENEACETIC ACID**

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ABSTRACT

Spermidine belongs to polyamines that are generally necessary for growth and development in most organisms. Naphthaleneacetic acid belongs to auxins. The response to auxin includes regulation of a broad number of genes. The influence of application of growth regulators depends on different factors such as type of growth regulators and the concentration of them. The aim of this study was evaluation of the influence of spermidine and naphthaleneacetic acid on vegetative and flowering characteristics of German chamomile. The plants were treated by foliar application of spermidine (50 and 100 mg/l) or naphthaleneacetic acid (50 and 100 mg/l) and distilled water (control), at the vegetative stage, before flower budding, twice within 10 days. The experiment was carried out using a completely randomized design (CRD) with three replications. The results showed that spraying by spermidine and naphthaleneacetic acid altered growth and flowering of chamomile plants significantly. Under present experimental conditions, foliar application of naphthaleneacetic acid at concentration of 50 mg/l can be recommended for obtaining the highest values of vegetative growth and flowering.

Keywords: *Matricaria recutita*, Plant Growth Regulators, Auxin, Polyamine, Medicinal Plants

INTRODUCTION

Matricaria recutita L. (syn. *M. chamomilla* L., *Chamomilla recutita* L. Rauschert) is from Compositae (Asteraceae) family. This plant is known as true chamomile or German chamomile. It has white ligulate flowers, smells pleasantly of chamomile (typical chamomile smell) and is annual. German chamomile can grow 10 to 80 cm in

height [1]. Chamomile is widely used throughout the world. Its primary uses are as a sedative, anxiolytic and antispasmodic, and as a treatment for mild skin irritation and inflammation. It has widespread use as a home remedy [2].

Spermidine is a polyamine. These are nitrogen compounds that are generally necessary for growth and development in most organisms [3]. Polyamines play an important role in regulation of plant membrane transport [4]. Polyamines influence some cellular processes such as cell division, root formation, flowering and retardation of senescence [5-9]. Growth of *Mentha piperita* was improved by application of polyamines [10].

Naphthaleneacetic acid (NAA) belongs to auxin group. The response to auxin includes regulation of a broad number of genes [11]. Singh *et al.* indicated that the maximum height and leaf numbers of *Salvia sclarea* L. were observed after application of kinetin (10 μ l/l) and IAA (50 μ l/l), respectively. The maximum flower and oil yield were observed after application of 40 μ l/l paclobutrazol [12]. Another report revealed that IAA up to 100 ppm increased shoot length in *Hippeastrum hybridum* [13].

A study indicated that auxins and polyamines improved the growth and production of rosmarinic acid in hairy root culture of *Nepeta cataria* [14].

The influence of application of growth regulators depends on different factors such as type of growth regulators and the concentration of them. The subject of this study was evaluation of the influence of spermidine and naphthaleneacetic acid on vegetative and flowering characteristics of German chamomile.

MATERIALS AND METHODS

Plant Materials and Experimental Conditions

The experiment was conducted on a garden in Shiraz (29°38' N, 52°28' E; 1486 m above sea level), state of Fars, Iran, on September (beginning of autumn). The pots were filled by a mixture contained 2/3 soil and 1/3 sand (v/v). This mixture was analyzed before sowing and the texture was sandy clay loam with PH=8.48, organic C=0.29%, total N=0.03%, available P=0.9 mg/kg, available K=274 mg/kg, TNV=53.8% and EC=1.02 ds/m. Before sowing of the seeds, the growing mixture of the pots was supplied with 3% (w/w) cow manure vermicompost. Chamomile seeds were germinated in pots and thinned at 2-4 leaves stage to one plant per each pot. The plants were treated by foliar application of NAA (50 and 100 mg/l) or spermidine (50 and 100 mg/l) and distilled water (control), at the vegetative stage, before flower budding, twice within 10 days. The experiment was carried out using a completely randomized design

(CRD) with three replications. Each replicate contained 15 pots. The flower heads were collected each 15 days during one month (three times), and were dried at room temperature. Finally, the number of main shoots, shoot height and shoot fresh weights were measured. The shoots were dried at 60°C for 72 hours in order to determine the shoot dry weights.

Statistical Analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using SAS computer software and the means compared with Duncan's new multiple range test (DNMRT) at $P < 0.05$.

RESULTS AND DISCUSSION

Spermidine and naphthaleneacetic acid altered vegetative characteristics of German chamomile significantly (**Table 1**). The highest value of main shoots number (7.86) was obtained at NAA₁₀₀ which was significantly different when compared to control and spermidine. Shoot height was the maximum (72.13 cm) at NAA₁₀₀ which was not significantly different when compared to NAA₅₀ and SP₅₀. The highest values of shoot fresh weight (265.13 g/plant) and shoot dry weight (56.30 g/plant) were achieved on NAA₅₀ which were significantly different when compared to other treatments. The lowest values of vegetative growth were achieved on control

that shows appropriate influence of these growth regulators.

Flowering characteristics of German chamomile were affected by growth regulators significantly (**Table 2**). The highest value of flower number at first harvest was achieved on NAA₁₀₀. The maximum of flower number at second and third harvest were obtained at NAA₅₀. The maximum of flower fresh and dry weights at second and third harvest were achieved on NAA₅₀.

The present results are in agreement with those obtained by other researchers regarding the medicinal plants. Foliar application of growth regulators like ethrel, indole acetic acid (IAA) and naphthalene acetic acid (NAA) at 50, 100 and 150 ppm, altered some characteristics in *Jatropha curcas* L., such as plant height, flower initiation, number of inflorescence per plant, number of male and female flowers per inflorescence [15]. An experiment regarding the foliar application of different concentration of auxins (IAA and 2,4-D) on *Verbascum thapsus*, a medicinal plant, revealed that IAA 50 ppm increased the shoot and root length, number of branches, nodes and leaves, while IAA 200 ppm was the best treatment for leaf area, number of flower and fruits [16]. Kumar by application of 10 and 50 ppm 2,4-D on groundnut

revealed that lower concentration is more effective to increase dry weight [17]. Spermidine could alter growth of German chamomile plants when compared to control. Polyamines affect thylakoid membranes in some species [18]. These compounds show specific binding to phospholipids and affect membrane rigidity [19] so they can affect growth and development. Polyamines (putrescine, spermidine and spermine) are found in a

range of physiological processes and in various environmental stresses [20]. Extracellular polyamines may interact with negatively charged cell wall components in some higher plants [21]. Polyamines promote polymerization of cytoskeletal components, influence DNA conformation and stability, and affect ribosomes during protein synthesis [22], therefore they can play an important role in vegetative and flowering characteristics of the plants.

Table 1: The influence of Growth Regulators on Vegetative Characteristics of German Chamomile

Growth regulators (mg/l)	Number of main shoots	Shoot height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Control	3.20c	51.26c	38.13d	7.36d
SP ₅₀	5.66b	68.40ab	149.90bc	32.40bc
SP ₁₀₀	5.60b	62.00b	124.23c	22.56c
NAA ₅₀	6.06ab	70.33a	265.13a	56.30a
NAA ₁₀₀	7.86a	72.13a	166.87b	38.10b

NOTE: Abbreviations: SP, Spermidine; NAA, Naphthaleneacetic Acid; In Each Column, Means With the Same Letters are Not Significantly Different at 5% Level of Duncan's New Multiple Range Test

Table 2: The Influence of Growth Regulators on Flowering Characteristics of German Chamomile

Growth regulators	FN1	FN2	FN3	FFW1 (g)	FFW2 (g)	FFW3 (g)	FDW1 (g)	FDW2 (g)	FDW3 (g)
Control	4.13c	6.87b	15.07d	13.17c	23.20b	36.93d	2.10c	2.50b	2.26d
SP ₅₀	13.17b	12.62a	23.55c	45.40b	35.07a	62.10c	7.50b	5.63a	7.36c
SP ₁₀₀	13.31b	13.40a	31.38bc	45.73b	34.83a	98.17b	8.23ab	5.56a	13.60b
NAA ₅₀	11.18b	14.51a	54.69a	49.43b	40.63a	153.40a	8.30ab	6.60a	25.33a
NAA ₁₀₀	18.89a	14.31a	39.18b	64.67a	40.20a	109.47b	11.13a	6.53a	15.76b

NOTE: Abbreviations: SP, Spermidine; NAA, Naphthaleneacetic Acid; FN1, Flower Number at First Harvest; FN2, Flower Number at Second Harvest; FN3, Flower Number at Third Harvest; FFW1, Flower Fresh Weight at First Harvest; FFW2, Flower Fresh Weight at Second Harvest; FFW3, Flower Fresh weight at Third Harvest; FDW1, Flower Dry Weight at First Harvest, FDW2, Flower Dry Weight at second harvest, FDW3, Flower Dry Weight at Third Harvest; In Each Column, Means With the Same Letters are Not Significantly Different at 5% Level of Duncan's New Multiple Range Test

CONCLUSION

Under present experimental conditions, naphthaleneacetic acid (NAA) at concentration of 50 mg/l can be recommended for obtaining the highest values of vegetative growth and flowering.

REFERENCES

- [1] Franke R, Plant Sources, In: Chamomile, Industrial Profiles. Edited by Franke R, Schilcher H, CRC Press, USA, 2005, 274.

- [2] Gardiner P, Chamomile (*Matricaria recutita*, *Anthemis nobilis*), 1999, Available: <http://www.mcp.edu/herbal/default.html>
- [3] Cohen S, A Guide to the Polyamines, Oxford University Press, New York, 1998, 595.
- [4] Pottosin I and Shabala S, Polyamines control of cation transport across plant membranes: implications for ion homeostasis and abiotic stress signaling, *Front Plant Sci.*, 5, 2014, 154.
- [5] Evans PT and Malmberg RL, Do polyamines have roles in plant development? *Annu Rev. Plant Physiol. Plant Mol. Biol.*, 40, 1989, 235-269.
- [6] Galston AW and Sawhney RK, Polyamines in plant physiology, *Plant Physiol.*, 94, 1990, 406-410.
- [7] Kumar A, Altabella T, Taylor MA and Tiburcio AF, Recent advances in polyamine research, *Trends Plant Sci.*, 2, 1997, 124-130.
- [8] Walden R, Cordeiro A and Tiburcio AF, Polyamines: small molecules triggering pathways in plant growth and development, *Plant Physiol.*, 113, 1997, 1009-1013.
- [9] Bouchereau A, Aziz A, Larher F and Martin-Tanguy J, Polyamines and environmental challenges: recent development, *Plant Sci.*, 140, 1999, 103-125.
- [10] Youssef AA, Aly MS, Abou Zied EN, Iliey L and Titiana S, Effect of some growth substances on mass production and volatile oil yield of *Mentha piperita*, *Egypt J. Appl. Sci.*, 17, 2002, 610-623.
- [11] Prins CL, Vieira IJC and Freitas SP, Growth regulators and essential oil production, *Braz. J. Plant Physiol.*, 22, 2010, 91-102.
- [12] Singh V, Sood R, Ramesh K and Singh B, Effects of growth regulator application on growth, flower, oil yield, and quality of clary sage (*Salvia sclarea* L.), *J. Herbs Spices Med. Plants*, 14, 2008, 29-36.
- [13] Bose TK, Jana BK and Mukhopadhyay TP, Effects of growth regulators on growth and flowering in *Hippeastrum hybridum* Hort., *Scientia Horticulturae*, 12, 1980, 195-200.
- [14] Yang YK, Lee SY, Park WT, Park NI and Park SU, Exogenous auxins and polyamines enhance growth and rosmarinic acid production in hairy root cultures of *Nepeta cataria* L., *Plant Omics J.*, 3 (6), 2010, 190-193.

- [15] Joshi G, Shukla A and Shukla A, Synergistic response of auxin and ethylene on physiology of *Jatropha curcas* L., Braz. J. Plant Physiol., 23 (1), 2011, 67-77.
- [16] Bhandari S, Sajwan M and Bisht NS, Physiological effect of auxins on growth characteristics and productive potential of *Verbascum thapsus* -a medicinal plant, Researcher, 1 (5), 2009, 47-51.
- [17] Kumar A, Effect of growth regulators on growth pattern, productivity minerals cycling and energy budget of groundnut (*Arachis hypogaea*) D. Phil Thesis Meerut Univ. Meerut (UP), 1982.
- [18] Besford RT, Richardson C, Campos JL and Tiburcio AF, Effect of polyamines on stabilization of molecular complexes in thylakoid membranes of osmotically stressed oat leaves, Planta, 189, 1993, 201-206.
- [19] Schuber F, Influence of polyamines on membrane functions, Biochem. J., 260, 1989, 1-10.
- [20] Shi H and Chan Z, Improvement of plant abiotic stress tolerance through modulation of the polyamine pathway, J. Integr. Plant Biol., 56 (2), 2014, 114-121.
- [21] Mariani P, D'Orazi D and Bagni N, Polyamines in primary walls of carrot cells: endogenous content and interactions, J. Plant Physiol., 135, 1989, 508-510.
- [22] Igarashi K and Kashiwagi K, Polyamines: mysterious modulators of cellular functions, Biochem. Biophys. Res. Commun., 271, 2000, 559-564.