

## Impact of Amino Acids Complex Foliar Application on Vegetative Growth, Flowering Traits and Chemical Constituents of Marigold (*Calendula officinalis* L.) plants

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**Abstract:** The effect of Aminomore (contained 15.78% amino acid mixture) spraying at 7 treatments and control (75, 150, 225, 300, 375, 450 and 525 ppm compared with control) were evaluated on marigold (*Calendula officinalis* L.) plants during 2016 and 2017 seasons. Plant height, stem thickness, number of lateral branches/ plant and number of leaves/plants greatly improved with spraying Aminomore and the effect was more pronounced with 450 ppm than in others. However, flowering traits including the number of flowering buds, number of opening flowers, flowering diameter and number of fruits greatly increased with all Aminomore concentrations than the control. The concentrations from 300 to 525 ppm were more effective than lower concentrations from 75 to 225 ppm in affecting flowering traits and fruits. Fresh and dry weights of shoots, roots and fruits improved with significant differences than in the control due to spraying of Aminomore. The concentrations of 375 and 450 ppm were more effective than other concentrations in positively affecting fresh and dry weights of shoot, roots and fruits of marigold plants. Macro and micronutrients of the different organs of marigold plants (roots, shoots and fruits) were greatly affected with Aminomore spraying. Notably, N and K were increased in all organs due to Aminomore spraying especially with 375 and 425 ppm compared with other concentrations. N content in fruits recorded higher values than those obtained in roots and shoots as a result of Aminomore spraying which means increasing in nutritive values to edible parts (fruits) of marigold plants. No clear effect to Aminomore spraying on P content was realized in different organs of Marigold plants which were similar to those found in control. A great effect to Aminomore spraying was found on Fe, Zn and Mn element contents in different Marigold organs (roots, shoots and fruits). A higher increase in those micronutrients was obtained than in the control especially with 375 and 450 ppm. Whereas no significant differences existed due to Aminomore spraying than the control in Cu content in both different Marigold organs, in both studied seasons.

**Key words:** Amino acids • Marigold • Vegetative growth • Flowering traits • Macronutrients • Micronutrients

### INTRODUCTION

*Calendula officinalis* L. (English marigold, Pot Marigold, Common marigold, Garden marigold or Scottish marigold) is one among the foremost vital cut flowers on the worldwide markets. It belongs to the aster family (Composite) family. The genus *Calendula* includes around twenty species, a number of that is native to Egypt as a part of the Mediterranean region [1].

Calendulas for decorative purposes embody cut flowers and potted flowering plants. Cut flowers could also be full-grown either within the field or within the

greenhouse [2]. They have inhibitor activities and play vital role in human health [3]. The most constituents of Marigold are include carbohydrates, phenolic compounds, lipids, steroids, terpenoids, tocopherols, carotenoids, quinones and water-soluble vitamin C [4]. Potted flowering plants are full-grown nearly completely within the greenhouse during a soilless substrate [5].

Marigold could be considered a medicinal- aromatic nonwoody annual or short- lived perennial herb native to southern Europe that produces orange to yellow flowers. However, the flowers and fruits is consumed as human food because of the active substances within it like

minerals, flavonoids and L- antioxidant [6]. Calendula grows quick which server nicety for the pharmaceutical and cosmetics industries [7].

Marigold is a very important winter flowering annual plant that's primarily utilized in planting flowerbeds in several varieties of gardens. Additionally to its landscape use and as a supply of color, it's additionally one among the most sources of natural yellow pigments applied in many industries [8].

Application of amino acids to medicative and aromatic plants plays several effective functions like improvement of recent cell development and consequently raised herb weights [9].

A positive impact of amino acids in fast growth and a few chemical constituents was rumored by Talaat *et al.*, [10] for Periwinkle (*Catharanthus roseus* L.), Abou- Dahab *et al.*, [11] for red Leaf philodendron (*Philodendron reubescens* K.), Nahed *et al.* [12] for *Thuja orientalis* L., Mahgoub *et al* [13] for *Dahlia pinnata* L. and El-Naggar *et al* [14] for Lily (*Lilium sp.* L.)

The great role of amino acids in plant is attributed to the correlation between these acids and plant vigor. Amino acids are used each for the assembly of recent cell biomass and to supply energy. Many industrial compounds that embody amino acids in their composition are counseled to be applied to extend the expansion and yield of economical crops. Some researchers indicate the interest of amino acids in increasing growth, yield and chemical synthesis of some scotch plants [15].

Accordingly this work was designed to guage the impact of spraying organic compound complicated (named Aminomore) with different concentrations on the performance of (*Calendula officinalis* L.) particularly on flowering traits and increasing the alimentary values of flowers and fruits for food consumption. Utilized in planting flowerbeds in several varieties of gardens. additionally to its landscape use and as a supply of color, it's additionally one among the most sources of natural yellow pigments utilized in many industries and within the bird-feed for poultry production [8].

## MATERIAL AND METHODS

This study was executed during 2015/2016 and 2016/2017 seasons on Marigold plants (*Calendula officinalis* L.). The seeds were sown in first of September 2015 and 2016, in the Ornamental Nursery, Faculty of Agric. Ain Shams University Cairo, Egypt. However, the seedlings were transplanted on the first week of

November in 2015 and 2016 seasons in 25 cm diameter pot filled with peat moss and sand (1:1). All horticultural practices including irrigation, macro and micro nutrients fertilization and pest management 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 of December 2015 (first season 2015/2016) and 2016 (second season 2016/2017) seasons and again on the same Marigold plants after two weeks in both studied seasons. Eight treatments were sprayed as follows:

- Control was sprayed with tap water.
- Foliar spraying with 75 ppm of Aminomore (0.5 cm<sup>3</sup>/liter)
- Foliar spraying with 150 ppm of Aminomore (1.0 cm<sup>3</sup>/liter)
- Foliar spraying with 225 ppm of Aminomore (1.5 cm<sup>3</sup>/liter)
- Foliar spraying with 300 ppm of Aminomore (2.0 cm<sup>3</sup>/liter)
- Foliar spraying with 375 ppm of Aminomore (2.5 cm<sup>3</sup>/liter)
- Foliar spraying with 450 ppm of Aminomore (3.0 cm<sup>3</sup>/liter)
- Foliar spraying with 525 ppm of Aminomore (3.5 cm<sup>3</sup>/liter)

The experiment was arranged in a randomized complete block design (RCBD) with 4 replicates for each treatment and each replicate contained 5 Marigold plants (8 treatments x 4 replicates x 5 plants= 160 marigold plants) in each season.

### Data Recorded

**Vegetative Growth Parameters:** Plant height (cm), stem thickness (cm), Number of lateral branches /plant and Number of leaves per plant were all measured in first of March 2016 (first season) and 2017 (second season).

**Flowering Traits:** Number of flower buds/ plant, number of opening flowers, flower diameter (cm) and number of fruits/ plant were calculated from the beginning of flower buds formation till fruits harvest in first of July in both seasons.

**Fresh and Dry Weights:** Fresh and dry weights for vegetative growth, roots and fruits were determined at the end of growing season (first of July in both seasons).















