

## Effect of Foliar Application of Salicylic Acid in Marigold

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### Abstract

Marigold (*Tagetes patula*) is one of the popular annual, herbaceous, attractive flowers. Salicylic acid (SA) is a phenolic phytohormone and is found in plants with roles in plant growth and development, photosynthesis, transpiration, ion uptake and transport. This research was conducted to assess the effects of foliar application of salicylic acid on growth and yield of marigold from July 2019 to November 2019. The research was conducted in the horticulture field of IAAS, Lamjung Campus, Nepal under Randomized Complete Block Design with three replications and six treatments viz. (0, 100, 200, 300, 400, 500) ppm of salicylic acid. The marigold flowers were harvested when the outer petals unfold nearly perpendicular to the stem. Parameters like plant height, plant width, days to flowering, number of flower diameter and total yield were observed and analyzed using SPSS. Greater plant height was found on treatment 500 ppm which is statistically on par with 400 ppm and 300 ppm and lowest at 0 ppm. Similarly, plant width is greater in 500 ppm while the lowest in 0 ppm. Days to flowering were lower in 500 ppm which is statistically similar with 400 ppm, 300 ppm and 200 ppm and higher in 0 ppm. Best results were found in 500 ppm with the number of flowers, the diameter of the flower, and flower yield. Thus, results revealed that increasing the concentration of salicylic acid increases the production of marigold.

**Keywords:** Foliar; Concentration; Parameter

### Introduction

Marigold (*Tagetes species*) are hardy annual or perennial ornamental crops which belongs to the family Asteraceae [1]. It's attractive and brilliant color flowers which are the most valuable economic part of the plant [2]. Marigold cultivation is flourishing and grabbing attention of producers and consumers because of its easy cultivation practices, wider adaptability, and shorter duration to produce marketable flowers and wide spectrum of color, shape, size, excellent shelf life respectively [3]. It's cultivation help small and marginal farmers for their economic upliftment hence known as poor man's crop [4]. They are sold in market as cut flower and loose flower. Traditionally, they are used as offering in temples, churches and also used in festivals, landscape and beautification. They are used as a garland and to offer god and goddess [5]. It is also suitable for pot culture, bedding purpose, window boxes, her-

baceous boarder to provide color and fill the space [6]. Generally, They are grown almost throughout the year but mainly grown to sell in Tihar festival [7]. Marigolds can be grown in a wide variety of soils and mild climate is favorable for its luxuriant growth and profuse flowering [8]. Marigold production in Nepal doesn't meet the consumer demands. Flowers worth million are imported into the country every year. According to Floriculture Association Nepal (FAN), 300,000 marigold garlands worth Rs 9 million was imported for Tihar festival [9]. Salicylic acid (SA) is a plant hormone which act as an antioxidant and play a significant role in regulating certain physiological processes in plants such as growth, germination, photosynthesis and ion absorption and also act as a signaling molecule to various environmental stresses [10]. It acts as the resistance to pathogens by inducing the production of pathogenesis-related proteins [11]. Marigold is an important flower in flower market

and has a greater scope. But sufficient research is not carried out in our country. So, to fill the research gap and to increase the flowering this experiment was carried out.

**Objective of the Study**

The main objective of this experiment was to observe the effect of foliar application of salicylic acid on growth and development of marigolds.

**Materials and Methods**

The experiment was carried out in horticulture farm in IAAS, Lamjung Campus, Sundarbazar in the western mid hills of Nepal during 2019. The place is located at sub-tropical climate with sub-humid type of weather conditions i.e. cold winter, hot summer and distinct rainy season. The seedling are imported from Floriculture Association of Nepal and transplanted in the prepared field with 50 x 50 cm<sup>2</sup> spacing. Intercultural operations like irrigation and weeding was done as required. Earthing up was done after 25 days of transplanting followed by staking with the help of bamboo stick when marigold plant attains about 50 - 55 cm height i.e. after 30 days of transplanting. At the date of 2<sup>nd</sup> November 2019, flowers are harvested and final data was taken. Parameters encompassing plant height, plant width, days to flowering, number of flowers, flower diameter, and total yield were observed and analyzed by using SPSS.

**Results and Discussions**

Treatments	Plant height (cm)	Plant width	Days to flowering
0ppm	133.67 <sup>b</sup>	11.35 <sup>c</sup>	61.00 <sup>a</sup>
100 ppm	142.75 <sup>b</sup>	14.05 <sup>b</sup>	58.67 <sup>b</sup>
200 ppm	144.62 <sup>ab</sup>	14.05 <sup>b</sup>	55.67 <sup>bc</sup>
300 ppm	146.48 <sup>ab</sup>	14.35 <sup>ab</sup>	54.33 <sup>bc</sup>
400 ppm	148.54 <sup>ab</sup>	16.50 <sup>a</sup>	53.33 <sup>bc</sup>
500 ppm	149.54 <sup>a</sup>	16.61 <sup>a</sup>	51.00 <sup>c</sup>
Significance	*	**	**

**Table 1:** Effect of different concentration of Salicylic acid on Plant height, plant width and days to flowering.

Means in column followed by similar letters are not significantly different.

\*: Significant at 5% level of significance.

\*\*: Significant at 1% level of significance.

The result revealed that plant height and width of marigold flower increased significantly with the foliar application of a successive dose of salicylic acid. Maximum value for these was found when 500 ppm of salicylic acid was applied whereas minimum value was observed in control treatments. The days of flowering is decreased significantly and the lowest days of flowering was found in 500 ppm of foliar application while the maximum was in 0 ppm.

**Plant height**

SA application increases the plant height because of increased rubisco chemical action and photosynthetic activity [12]. SA causes plant growth to increase with increasing cell division in both stem and roots, thus increasing plant height under greenhouse and field conditions [13].

**Plant width**

The increase in plant spread with salicylic application might be due to the vegetative growth as salicylic acid synthesizes protein called kinase which helps in division and differentiation of cells [14].

**Days of flowering**

Decrease in flowering days in plants due to the foliar application of salicylic acid may be attributed to the role of plant hormone including jasmonic acid, ethylene, and auxin [15]. SA increases the endogenous bioactive GA content in the response and changes the hormonal status of the plant which results in early flowering [16,17].

Treatments	Number of flower	Flower diameter	Flower yield
0 ppm	1.43 <sup>b</sup>	4.70 <sup>b</sup>	234.71 <sup>c</sup>
100 ppm	1.83 <sup>b</sup>	4.80 <sup>b</sup>	256.67 <sup>c</sup>
200 ppm	1.83 <sup>b</sup>	4.83 <sup>b</sup>	278.67 <sup>c</sup>
300 ppm	2.87 <sup>ab</sup>	5.20 <sup>ab</sup>	328.54 <sup>b</sup>
400 ppm	3.67 <sup>ab</sup>	5.40 <sup>ab</sup>	375.23 <sup>b</sup>
500 ppm	4.42 <sup>a</sup>	5.76 <sup>a</sup>	428.67 <sup>a</sup>
Significance	*	*	**

**Table 2:** Effect of different concentration of salicylic acid on number of flowers, flower diameter and flower yield.

Means in column followed by similar letters are not significantly different.

\*=significant at 5% level of significance.

\*\*= significant at 1% level of significance.

### Number of flower

It was observed that maximum number of flowers was found on 500 ppm (4.42), which is statistically at par with 400 ppm. Minimum number of flowers was found on 0 ppm (7.33), statistically at par with 100 ppm and 200 ppm. Maximum number of flowers was obtained at high concentrations of salicylic acid however minimum in number were obtained at control treatment due to an increase of photosynthetic rate that leads to maturity of leaves. Foliar application of SA has influence on plant growth and the net photosynthesis rate which is positively associated with the crop yield [18].

### Flower diameter

The data regarding flower diameter as affected by different SA concentrations was collected and analyzed. Result revealed that the maximum diameter was observed in 500 ppm (5.76 cm), which is statistically at par with 400 ppm and 300 ppm. Minimum diameter was found in 0 ppm (4.7 cm). Flower diameter is greater at higher concentration of salicylic acid as compared to control and low concentration of salicylic acid. Salicylic acid has positive effect on photosynthesis which results higher amount of carbohydrate in leaves and stem due to this flower size increases. The synergism between SA and auxins may also results higher flower diameter. SA has positive effect on flower size as it changed the biophysical properties of cell wall [19].

### Flower yield

The result suggests that application of 500 ppm concentrations of salicylic acid has positive effect of yield of marigold. The yield of marigold was lower in 0 ppm or control treatments. Flower inducing and regulating activities of salicylic acid has been well known for a long time [20].

Salicylic acid intensified the net photosynthetic rate, internal CO<sub>2</sub> concentration and water use efficiency which ultimately influence the final yield [21]. Salicylic acid has positive effect on growth and yield of plant as it influences the plant hormones.

Salicylic acid has well-known roles in photosynthetic parameters and plants water relations and it enhances the yield [22].

### Conclusion

Various parameters like plant height, plant width, days to flowering, number of flowers, flower diameter, and total yield were observed and the effect of treatment on all parameters were found to be significant and revealed that maximum number of flowers (4.42) was recorded at plants sprayed with 500 ppm of salicylic

acid which is statistically at par with 400 ppm and 300 ppm whereas minimum (1.43) was found in controlled. Considering the excellence in all the parameters in the study, it exhibited that with the increasing the foliar application of salicylic acid there is an increasing tendency in the growth and flowering attributing characters of marigold. Hence, results revealed that increasing concentration of salicylic acid increases the number and yield of flower. This research can be extended further to study all flowering attributes, and post-harvest technologies.

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