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# MORPHOLOGICAL AND PHYSIOLOGICAL CHANGES OF GROUNDNUT PLANTS BY FOLIAR APPLICATION WITH SALICYLIC ACID

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ABSTRACT

The purpose of this research is to examine the effects of salicylic acid applied topically to groundnut plants at concentrations of 100, 200, and 400 mg/L on the plant's vegetative development, photosynthetic pigment content, yield, and several biochemical components of groundnut grains, as well as the interactions between these factors. There was a positive correlation between plant growth characteristics and yield, according to the data. After adding 100 or 200 mg/L of salicylic acid (SA), groundnut grains exhibited an increase in total carbohydrates, lipids, and proteins. Results for yield and the aforementioned components were lowest when SA was administered at 400 mg/L in comparison to the control groups.

## INTRODUCTION

An annual legume, groundnuts are a valuable cash crop. Groundnuts are grown in India, which is also the world's leading producer of this oil seed crop. One third is used as food, while around two thirds is crushed for oil. Hunks provide high-quality fodder, and its cake is used as feed or in the production of other edible goods. Using a chemical desiccant applied topically to wheat plants is one way to cause crop losses (Gaballah and Mandour, 2003; Nicolas and Turner, 1993). Plants contain trace levels of salicylic acid (SA), which plays a role in controlling various physiological processes (Raskin, 1992; Khan et al., 2003; Shakirova et al., 2003), including stomatal closure, nutrient uptake, chlorophyll synthesis, protein synthesis, transpiration, and photosynthesis. SA also inhibits ethylene biosynthesis. After a pathogen attacks a plant, it is crucial for the establishment of both the local and systemic disease resistance response (Alvarez, 2000).Mulpuri et al. (2000) found that plants respond to biotic and abiotic stress factors via signalling pathways depending on salicylic acid, jasmonic acid, and ethylene. According to Metwally et al. (2003), barley's anti-accident enzyme activities were either fully or significantly reduced after being treated with SA at a concentration of 0.5 mM.
Researchers have been using SA in a variety of crop plants in an effort to regulate their growth and development patterns and increase their systemic resistance to harmful environmental agents due to the profound effects SA has on plant structure and function. There are a number of levels, plant species, developmental phases, and environmental factors influence its ability to stimulate certain physiological processes while suppressing others (Ding and Want, 2003; Mateo et al., 2006). According to research conducted by Gutierrez-Coronado et al. (1998), Shakirova et al. (2003), Shehata et al. (2001), Abdel-Wahed et al. (2006), El-mergawi and Abdel-Wahed (2007), and SA, the number of flowers, pods of plants, and soybean yield were all increased. According to Kord and Hathout (1992), salicylic acid decreased tomato plant development and chlorophyll levels at relatively high concentrations. Plants of wheat (Singh and Usha, 2003; Iqbal and ashraf, 2006) and lupines (Haroun et al., 1998). So, it's reasonable to assume that SA affects groundnut plant development and yield.
The current research aimed to increase groundnut development, yield, grain quality, and nutritional value by studying the influence of spraying SA separately on several morphological parameters, yield, and biochemical components.

## MATERIALS AND METHODS

Establishing a groundnut field
Aqueous mercuric chloride (0.1%) was used to surface sterilise groundnut seeds for 15 minutes, followed by 70% alcohol for 1 minute, at the seedling stage. Seeds were immersed in sterile distilled water for a full wash after each sterilisation on a laminar airflow bench. The seeds, which had been surface sterilised, were planted in 15 cm diameter pots.
Therapy with salicylic acid
The plants, which were about 30 days old, were sprayed with the use a handheld sprayer to evenly apply salicylic acid to the leaves. The leaves were sprayed with a solution until every

surface was coated. A mixture of 20 mM SA, distilled water, and 0.05% Tween 80 was used to create the spray solution. The distilled water-based control spray solution has 0.05% Tween 80.

Methodology The plants were divided into two groups. Two sets were prepared: one without SA treatment and one with SA treatment. At three separate times, the SA was subjected to three distinct concentrations: 100, 200, and 400 mg/L. Around 110 days after planting, when the crop was ready to be harvested, notes were taken.

Developmental traits The growth characteristics of the plants were assessed after SA treatments by measuring their height and dry weight (g) (Bremmer and Taha, 1966).

Calculating the amount of chlorophyll in leaves According to Arnon (1949), the amount of chlorophyll in the leaves was determined. Nutritional value estimation for grains The phenol sulphuric technique was used to estimate the total carbohydrate content in the dried grains (Dubois et al., 1956). According to Lowry et al. (1951), proteins were estimated. Grain fat content was also calculated.

## RESULTS AND DISCUSSION

### Growth criteria

Foliar applications of salicylic acid at concentrations of 100 and 200 mgL-1 improved groundnut plant growth indices as compared to untreated plants, as shown in Table 1. Among the treatments tested, salicylic acid at a concentration of 100 mg L-1 significantly improved growth metrics. In contrast, groundnut plant development characteristics were shown to diminish considerably when the Maximum salicylic acid concentration: 400 milligrammes per litre. Regarding this matter, numerous researchers have discovered that soybean, maize, and wheat plants can all benefit from low concentrations of salicylic acid (Gutierrez-Coronado et al., 1998; Shehata et al., 2001; El-Mergawi and Abdel Wahed, 2007; Shakirova et al., 2003; Iqbal and Ashraf, 2006), while tomato, lupine wheat, and maize plants are inhibited at high concentrations (Haroun et al., 1998; Singh and Usha 2003; Abdel-Wahed et al., 2006). In addition, El-Bahay (2002) found that salicylic acid could affect the growth of Lupine seedlings in either a stimulative or suppressive way by interfering with the enzyme activities that are responsible for the production and breakdown of substances that promote or inhibit growth. Substances that are used for photosynthesis

Table 2 displays the results of a foliar spray of salicylic acid on the photosynthetic pigments in groundnut plant leaves. Chlorophyll a, chl b, and carotenoids were all substantially boosted by salicylic acid, reaching their maximum concentrations at 100 mg/L. Using a larger dosage of salicylic acid had the opposite effect, changing the amount of these pigments. These findings are in line with those of Gharib (2006), who discovered that salicylic acid at 10-5 M promoted total chlorophyll production in marjoram and sweet basil plants, whereas 10-3 M had the opposite effect. The components of yield

Table 3 shows that the greatest increase in grain production and nutritional value was seen with foliar treatment of salicylic acid, particularly at 100 mg L-1. When compared to the control groups, the yield and component values for SA at 400 mg L-1 were the lowest. Here, salicylic acid applied topically to maize plants considerably raised yield and maize yield components (Shehata et al., 2001; Abdel- wahed et al., 2006) and wheat plants (Shakirova et al., 2003; Iqbal and Ashraf, 2006).

Table 1: Growth criteria of groundnut after foliar application of SA

| SA treatments mg $L^{-1}$ | After 50 days from sowing | | After 100 days from sowing | | After 150 days from sov ing | |
|---|---|---|---|---|---|---|
| | Plant height (cm) | Dry weight (g) | Plant height (cm) | Dry weight (g) | Plant height (cm) | Dry weight (g) |
| Control | 35 | 19.98 | 45 | 20.78 | 46 | 20.98 |
| 100 | 40 | 20.87 | 50 | 21.00 | 52 | 21.54 |
| 200 | 46 | 21.65 | 56 | 22.65 | 58 | 23.78 |
| 400 | 36 | 19.34 | 46 | 20.34 | 48 | 20.21 |

Table 2: Effect of foliar spray with Salicylic acid on the photosynthetic pigments of groundnut leaves

| SA treatment $mgL^{-1}$ | After 50 days from sowing | | | After 100 days from sowing | | | After 150 days from sowing | | |
|---|---|---|---|---|---|---|---|---|---|
| | Chl a (mg/g) | Chl b (mg/g) | Carotenoid (mg/g) | Chl a (mg/g) | Chl b (mg/g) | Carotenoid (mg/g) | Chl a (mg/g) | Chl b (mg/g) | Carotenoid (mg/g) |
| Control | 0.67 | 0.43 | 2.889 | 0. 68 | 0.47 | 2.888 | 0.69 | 0.48 | 2.889 |
| 100 | 0.89 | 0.66 | 4.075 | 0.94 | 0.86 | 4.079 | 0.95 | 0.92 | 4.082 |
| 200 | 0.78 | 0.58 | 5.312 | 0.81 | 0.63 | 5.318 | 0.81 | 0.67 | 5.316 |
| 400 | 0.61 | 0.46 | 3.498 | 0.65 | 0.48 | 3.406 | 0.67 | 0.49 | 3.397 |

Table 3: Nutritional values of groundnut grain after foliar application of SA

| SA treatment mg $L^{-1}$ | Carbohydrates (g) | Fat (g) | Protein (g) |
|---|---|---|---|
| Control | 21 | 48 | 25 |
| 100 | 28 | 56 | 31 |
| 200 | 25 | 54 | 30 |
| 400 | 20 | 49 | 27 |

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