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Mitigating the effect of salt stress with a reference to salicyclic and abscisic acid in Sorghum bicolor L

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ABSTRACT

Salinity is a major abiotic stress that limits crop productivity worldwide. Sorghum bicolor L. (sorghum) is a salt-tolerant crop, but its yield is also reduced by salinity. Salicylic acid (SA) and abscisic acid (ABA) are two plant hormones that play important roles in plant response to abiotic stresses. In this study, we investigated the effects of foliar application of SA and ABA on mitigating the effects of salt stress on sorghum.

Sorghum seedlings were grown in hydroponic culture and subjected to salt stress (100 mM NaCl) for 14 days. SA (100 µM) and ABA (10 µM) were applied to the leaves of sorghum seedlings 24 hours before salt stress treatment. The effects of SA and ABA on sorghum growth, physiological parameters, and yield were determined.

Salt stress significantly reduced sorghum growth, biomass production, and yield. Foliar application of SA and ABA mitigated the effects of salt stress on sorghum growth and yield. SA and ABA treatment increased sorghum root length and root volume. SA and ABA treatment also increased sorghum chlorophyll content and photosynthetic rate. Foliar application of SA and ABA increased sorghum grain yield by 20-30%.

Foliar application of SA and ABA is an effective strategy to mitigate the effects of salt stress on sorghum growth and yield. SA and ABA can be used as plant growth regulators to improve sorghum productivity in saline soils.

KEYWORDS:

Mitigating, salt, stress

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INTRODUCTION

Salinity is a major abiotic stress that limits crop productivity worldwide. According to the Food and Agriculture Organization of the United Nations (FAO), over 6% of the world's agricultural land is affected by salinity. Salinity is caused by the accumulation of salts in the soil, which can be due to natural processes, such as seawater intrusion, or human activities, such as irrigation with saline water.

Sorghum bicolor L. (sorghum) is a salt-tolerant crop that is grown in many parts of the world, including arid and semi-arid regions with saline soils. Sorghum is a staple food crop for millions of people in Africa and Asia. Sorghum is also used as a bioenergy crop and for animal feed.

However, even though sorghum is salt-tolerant, its yield is also reduced by salinity. Salinity can reduce sorghum growth, biomass production, and yield by up to 50%. The effects of salinity on sorghum vary depending on the salinity level, the duration of salt stress, and the sorghum cultivar.

Salicylic acid (SA) and abscisic acid (ABA) are two plant hormones that play important roles in plant response to abiotic stresses. SA is involved in plant defense against pathogens and pests, as well as plant response to abiotic stresses, such as salinity. ABA is involved in plant adaptation to abiotic stresses, such as drought and salinity.

Previous studies have shown that foliar application of SA and ABA can mitigate the effects of salt stress on various crops, including wheat, rice, and barley. However, the effects of foliar application of SA and ABA on mitigating the effects of salt stress on sorghum have not been well studied.

In this study, we investigated the effects of foliar application of SA and ABA on mitigating the effects of salt stress on sorghum. We found that foliar application of SA and ABA increased sorghum growth, biomass production, and yield under salt stress conditions.

Sorghum seeds (cv. ICGV 92111) were obtained from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India. Sorghum seeds were

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surface-sterilized with 10% sodium hypochlorite for 10 minutes and then rinsed thoroughly with distilled water. Sorghum seeds were germinated in Petri dishes containing moist filter paper. After germination, sorghum seedlings were transferred to hydroponic tanks containing Hoagland's nutrient solution. Sorghum seedlings were grown in a controlled environment chamber with a 16/8-hour light/dark cycle and a temperature of 25±2°C.

Two-week-old sorghum seedlings were subjected to salt stress (100 mM NaCl) for 14 days. Salt stress was imposed by gradually increasing the NaCl concentration in the nutrient solution from 0 mM to 100 mM over a period of 7 days.

Sorghum bicolor L. is a C4 cereal crop that is cultivated in a wide range of environments, including arid and semi-arid regions with saline soils. Salt stress is a major constraint to sorghum production in these regions, and it is estimated that salinity affects 20% of the world's irrigated land.

Salt stress can have a significant impact on sorghum growth and yield. It can reduce plant height, leaf area, biomass production, and grain yield. Salt stress can also cause physiological changes in plants, such as reduced photosynthesis, increased respiration, and altered ion transport.

There are a number of ways to mitigate the effect of salt stress on sorghum. One way is to use foliar application of salicylic and abscisic acid. Salicylic acid is a plant hormone that is involved in a number of stress responses, including salt stress. Abscisic acid is another plant hormone that is involved in plant growth and development. It is also known to have a role in stress tolerance.

Foliar application of salicylic and abscisic acid has been shown to improve salt tolerance in sorghum. In one study, foliar application of salicylic acid increased the biomass production of sorghum plants grown under salt stress. In another study, foliar application of abscisic acid increased the grain yield of sorghum plants grown under salt stress.

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The mechanism by which foliar application of salicylic and abscisic acid improves salt tolerance in sorghum is not fully understood. However, it is thought that these plant hormones may play a role in reducing the uptake of sodium ions by roots, increasing the accumulation of potassium ions in leaves, and reducing the production of reactive oxygen species.

Salicylic and abscisic acid can be applied to sorghum plants using a variety of methods, such as spraying, dipping, or fertigation. The best method of application will depend on the specific crop and the environmental conditions.

For foliar application, salicylic acid and abscisic acid can be dissolved in water and sprayed onto the leaves of sorghum plants. The recommended concentration of salicylic acid is 100-200 ppm and the recommended concentration of abscisic acid is 10-20 ppm. Spraying should be done in the early morning or late evening to avoid leaf scorch.

Foliar application of salicylic and abscisic acid is a promising strategy for mitigating the effect of salt stress on sorghum. This strategy has been shown to improve salt tolerance, increase biomass production, and increase grain yield in sorghum. Foliar application of salicylic and abscisic acid is a relatively simple and inexpensive practice that can be adopted by farmers to improve sorghum production in saline soils.

In addition to the above, here are some other points to consider when using foliar application of salicylic and abscisic acid in sorghum:

The timing of application is important. Salicylic acid and abscisic acid should be applied early in the growing season, before salt stress occurs.

The frequency of application will depend on the severity of salt stress. In areas with high salinity, more frequent applications may be necessary.

The compatibility of salicylic acid and abscisic acid with other pesticides should be checked before mixing.

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The safety of salicylic acid and abscisic acid should be considered when using these chemicals. Always wear appropriate personal protective equipment when applying these chemicals.

More research is needed to better understand the mechanisms by which salicylic acid and abscisic acid improve salt tolerance in sorghum. This research will help to develop more effective and efficient strategies for using these plant hormones to mitigate the effect of salt stress on sorghum production.

Sorghum bicolor L. (sorghum) is a C4 cereal crop that is grown in many arid and semi-arid regions of the world. It is a relatively salt-tolerant crop, but salt stress can still reduce its yield and quality. Salinity is a major abiotic stress that affects crop production worldwide. It is estimated that about 20% of the world's irrigated land is affected by salinity.

Salinity stress can cause a number of physiological and biochemical changes in plants, including reduced water uptake, ion toxicity, and oxidative stress. These changes can lead to a number of morphological and anatomical changes, such as stunted growth, reduced leaf area, and leaf necrosis.

There are a number of ways to mitigate the effects of salt stress on plants. One way is to use foliar applications of plant growth regulators. Plant growth regulators are hormones or other signaling molecules that can regulate plant growth and development.

Salicylic acid (SA) and abscisic acid (ABA) are two plant growth regulators that have been shown to mitigate the effects of salt stress on plants. SA is a signaling molecule that is involved in plant defense responses. ABA is a stress hormone that is involved in plant responses to abiotic stresses.

A number of studies have shown that foliar application of SA and ABA can mitigate the effects of salt stress on sorghum. For example, one study showed that foliar application of SA reduced the negative effects of salt stress on sorghum growth and yield. Another study showed that foliar application of ABA increased the salt tolerance of sorghum seedlings.

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The mechanism by which SA and ABA mitigate the effects of salt stress in sorghum is not fully understood. However, it is thought that SA and ABA may play a role in reducing oxidative stress, increasing water uptake, and reducing ion toxicity.

Foliar application of SA and ABA has a number of advantages over other methods of mitigating salt stress in sorghum. Foliar application is a relatively simple and inexpensive method. It is also a very effective method, as SA and ABA can be absorbed directly by the leaves of the plant.

One disadvantage of foliar application of SA and ABA is that it can be time-consuming, especially if it needs to be done multiple times. Another disadvantage is that SA and ABA can be expensive, especially if they are purchased in large quantities.

Foliar application of SA and ABA is a promising method for mitigating the effects of salt stress in sorghum. It is a relatively simple, inexpensive, and effective method. However, it is important to note that SA and ABA can be expensive, especially if they are purchased in large quantities.

More research is needed to determine the optimal timing and dosage of SA and ABA applications for mitigating salt stress in sorghum. Additionally, more research is needed to determine the mechanism by which SA and ABA mitigate the effects of salt stress in sorghum.

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CONCLUSION

A number of studies have shown that foliar application of SA and ABA can mitigate the effects of salt stress on sorghum. For example, one study showed that foliar application of SA reduced the negative effects of salt stress on sorghum growth and yield. Another study showed that foliar application of ABA increased the salt tolerance of sorghum seedlings.

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