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# SALICYLIC ACID ENHANCES YIELD COMPONENTS AND GRAIN PRODUCTIVITY OF SPRING MAIZE VARIETIES UNDER THE AGRO-ECOLOGICAL CONDITIONS OF PESHAWAR

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**Abstract**
*Spraying of salicylic acid (SA) on leaves can stimulate plant physiological activity, and probably influence yield formation in maize. A field experiment was conducted at the Agronomy Research Farm, The University of Agriculture, Peshawar in the spring 2023 to assess the effects of SA levels (0, 100, 200 and 300 mg L^-1), maize varieties (CS-200 and Azam) and application stage (V8 and VT) on yield components and grain productivity. Three replications of an RCBD were used to arrange treatments. The 300 mg L^-1 SA treatment gave the highest rows ear^-1 (13.1), grains row^-1 (36.3), grains ear^-1 (483), 1000-grain weight (303.5 g), grain yield (4951 kg ha^-1), biological yield (14026 kg ha^-1), harvest index (35.4%) and shelling percentage (82.5%). CS-200 outperformed Azam for grain yield (5040 kg ha^-1), biological yield (14305 kg ha^-1), 1000-grain weight (345.6 g) and grains ear^-1 (488). V8 showed better application than VT for yield components and grain yield. The findings indicated 300 mg L^-1 of SA was more suitable for Peshawar conditions and enhancing maize productivity at V8. The salicylic acid (SA) treatment improved maize yield by 10% and biological yield by 5% compared to the untreated control.The salicylic acid (SA) treatment increased the yield of maize by 10% and biological yield by 5% compared to the untreated control.*

## INTRODUCTION

Maize is one of the significant cereal crops, however, the productivity of this crop in Pakistan is far from being the potential observed with improved management. Maize grain yield require successful vegetative development and a normal reproductive development and the use of assimilates efficiently to produce grain. Therefore, management practices that enhance the activities of the leaves, stress tolerance and grain filling can enhance final yield.

Salicylic acid has been identified as an endogenous growth regulator that can affect plant growth, stress response, antioxidant activity and source-sink relationships (Raskin, 1992; Ashraf et al., 2010). In maize, the application of SA has been reported to enhance growth and yield under different abiotic stresses which included drought, salinity, low temperature stress, and limited irrigation (Ahmad et al., 2014; Ahmad et al., 2018; Qasim et al., 2019; Tufail et al., 2013).

Integrated nutrient management, soil amendment with biochar, beneficial microbe, management of zinc and pest pressure are also some of the recent findings of the region to boost the productivity of crops in KP, while water quality is also a significant environmental constraint for sustainable agriculture in the region (Farooq et al., 2026a; Farooq et al., 2026b; Jalal et al., 2026; Khan et al., 2026a; Khan et al., 2026b; Sherin et al., 2026; Anees et al., 2026; Rehman et al., 2026; Khan and Khan, 2026; Khan et al., 2025).

In the present manuscript the emphasis is on the yield component and the productivity reaction of spring maize to the dose of SA, as well as growth-stage timing. The aim was to determine the optimum level of S.A. and optimum time of its application for better production of grain and its related traits under the Peshawar environment.

## Materials and Methods

The field experiment was carried out at the Agronomy Research Farm, The University of Agriculture, Peshawar, in the spring, 2023. The design of the trial was randomized complete block with three replications. The experimental factors were SA levels (0, 100, 200 and 300 mg L-1), maize varieties (Hybrid CS-200 and Azam) and application stage (V8 and VT). The plots were 14 m2 in size and consisted of five rows. The recommended fertilizer level of 120:90:60 kg ha^-1 was applied, and all the agronomic practices performed throughout the crop season.

Yield related observations were number of rows ear^-1, grains row^-1, grains ear-1, 1000-grain weight, biological yield, grain yield, HI and shelling percentage. Grain yield and biological yield were converted to kg ha^-1. Harvest index was defined as grain yield/biological yield, and presented as per cent. The analysis of variance and LSD at P <= 0.05 was performed on the thesis with the Statistix 8.1. In this manuscript, the original treatment means were not altered but shown graphically using Python.

## Results

Consistently all yield components and yield indices were improved by an increase in SA level. The control treatment produced the lowest mean values for grains ear^-1 (373), 1000-grain weight (265.0 g), biological yield (12008 kg ha^-1), grain yield (4000 kg ha^-1), harvest index (33.3%) and shelling (78.3%). The grain yield of 4951 kg ha-1 and biological yield of 14026 kg ha-1 were obtained with 300mgL-1 treatment which recorded the highest values for both these traits.

**Table 1 Effect of different salicylic acid levels on yield components and yield performance of maize.**

| SA (mg L^-1) | Rows ear^-1 | Grains row^-1 | Grains ear^-1 | 1000 grain wt. (g) | Biological yield | Grain yield | HI (%) | Shelling (%) |
|---|---|---|---|---|---|---|---|---|
| 0 | 11.7 | 33.0 | 373 | 265.0 | 12008 | 4000 | 33.3 | 78.3 |
| 100 | 12.3 | 35.0 | 455 | 298.3 | 13030 | 4688 | 36.0 | 79.4 |
| 200 | 12.4 | 35.0 | 471 | 298.2 | 13990 | 4864 | 34.8 | 80.5 |
| 300 | 13.1 | 36.0 | 483 | 303.5 | 14026 | 4951 | 35.4 | 82.5 |

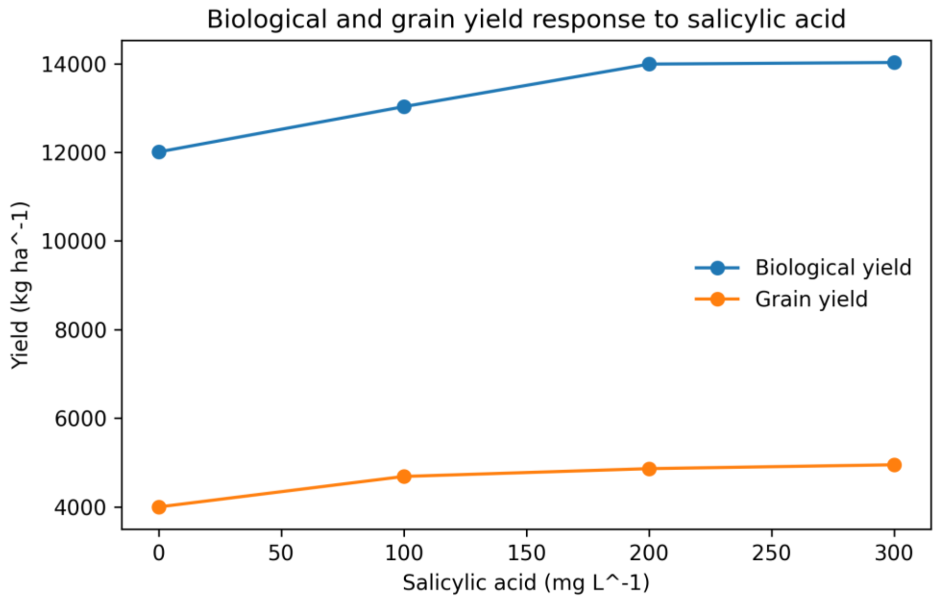


**Figure 1 Effect of salicylic acid levels on biological yield and grain yield of maize.**

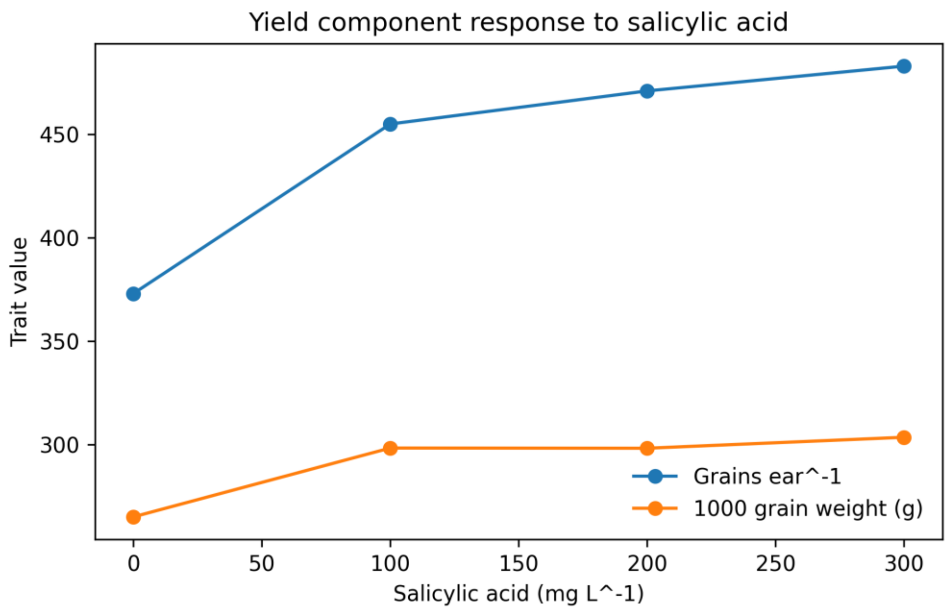


**Figure 2 . Effect of salicylic acid levels on grains ear^-1 and 1000-grain weight of maize.**

Variety means revealed that the yield potential of CS-200 was higher than Azam. CS-200 recorded 13.0 rows ear^-1, 35.6 grains row^-1, 488 grains ear^-1, 345.6 g 1000-grain weight, 14305 kg ha^-1 biological yield and 5040 kg ha^-1 grain yield. Generally, yield components and yield were better in the V8 than in VT.

**Table 2. Performance of maize varieties and salicylic acid application stages for yield components and yield traits.**

| Trait | CS-200 | Azam | V8 | VT |
|---|---|---|---|---|
| Rows ear^-1 | 13.0 | 11.7 | 12.7 | 12.0 |
| Grains row^-1 | 36.0 | 34.0 | 36.0 | 34.0 |
| Grains ear^-1 | 488.0 | 402.0 | 457.0 | 434.0 |
| 1000 grain weight (g) | 345.6 | 236.9 | 299.6 | 282.9 |
| Biological yield (kg ha^-1) | 14305.0 | 12222.0 | 13831.0 | 12696.0 |
| Grain yield (kg ha^-1) | 5040.0 | 4212.0 | 4820.0 | 4432.0 |
| Harvest index (%) | 35.3 | 34.4 | 34.8 | 34.9 |
| Shelling (%) | 81.8 | 78.6 | 80.4 | 79.9 |

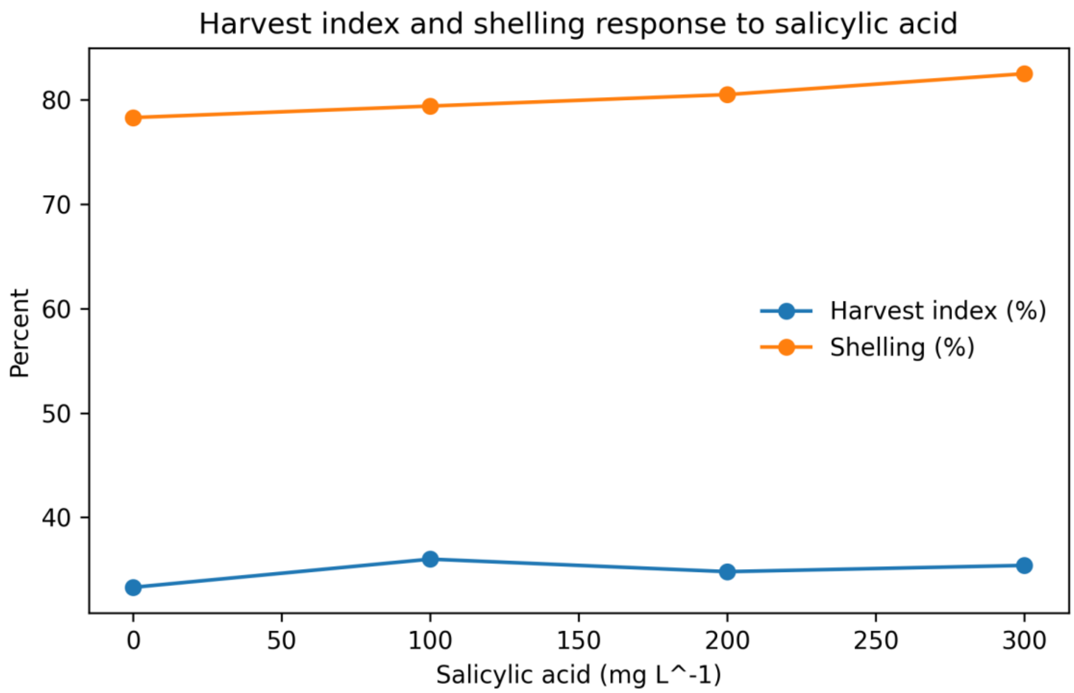


**Figure 3 Effect of salicylic acid levels on harvest index and shelling percentage of maize.**

**Discussion**

The yield components improvement at high SA levels is indicative of an increase in physiological support for grain formation, which was provided by foliar SA. Better ear development and grain filling are reflected by higher grain number of ears and 1000-grain weight. This is in line with previous reports where foliar SA enhanced maize yield, ear parameters and grain weight under water stress and deficit irrigation (Ahmad et al., 2018; Qasim et al., 2019; Zamaninejad et al., 2013).

The results show that the application of SA is effective in increasing grain yield, from 4000 kg ha^-1 (control) to 4951 kg ha^-1 (300 mg L^-1), providing proof of its use in the field of spring maize. The increase in both biological yield and grain yield may have resulted in an increase in total biomass productivity and in partitioning to grain production. This is confirmed by the higher harvest index at 300 mg L^-1.

Planting varieties are significant with foliar growth regulators as in the case of CS-200. The higher grain weight, grains ear^-1 and biological yield of CS-200 indicated its superior use of applied SA. The superiority of V8 over VT suggests that enough time can be allowed for physiological improvement to make a contribution to ear development and final yield if earlier application is practiced.

**Conclusion**

Salicylic acid was effective in enhancing yield parameters and productivity of spring maize when applied foliarly. The treatment of 300mgL-1 yielded the maximum number of rows/ear, grains/row, grains/ear, 1000-grain weight, biological yield, grain yield, harvest index and shelling percentage. Hybrid CS-200 yielded better than Azam and the V8 application performed better compared to VT application. From the results, it is recommended to use 300 mg L^-1 SA treatment at V8 stage for enhancing yield formation and grain productivity of spring maize under agro-ecological conditions of Peshawar.

**Recommendations**

The experiment should be repeated across seasons and locations before large-scale recommendation. Future work should include economic analysis, chlorophyll and photosynthetic measurements, and interaction of SA with irrigation and nutrient management to identify the most profitable and climate-resilient production package for maize farmers.

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