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Original Research Article

TRENDS OF GERMINATION IN CHILLI SEEDS

ASHRAF A[1], SHAHID S[*2], BIBI B[3], MUMTAZ M[4], MARRI JK[5], ULLAH I[6], HUSSAIN T[7], KHADIM K[2], ARIF A[2], FAIZ A[1]

[1]*Department of Botany, University of Agriculture, Faisalabad, Punjab, Pakistan*
[2]*Department of Botany, Lahore College for Women University, Punjab, Pakistan*
[3]*Department of Chemistry, The Government Sadiq College Women University, Bahawalpur, Punjab, Pakistan*
[4]*Department of Botany, University of Sargodha, Punjab, Pakistan*
[5] *On Farm Water Management Department, Quetta, Balochistan, Pakistan*
[6]*Faculty of Agriculture, Department of Horticulture, Bahauddin Zakariya University, Multan, Punjab, Pakistan*
[7]*Department of Chemistry, Government College University, Faisalabad, Punjab, Pakistan*
**Corresponding author`s email address:* sawairashahid@bs.qau.edu.pk

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Abstract: *The germination of chilli seeds has traditionally been impacted by physiological or endogenous dormancy traits. Low seed germination rates and vigor growth are issues that could contribute to the poor seedling development of the chilli crop. The most common treatment solution, gibberellic acid (GA3), is not a novel technique for breaking the dormancy of chili seeds. However, further research is required to determine the possible impact of this treatment on the germination of chilli seeds and the growth of seedlings, including the pursuit of an improved GA3 concentration. Thus, the purpose of this study was to assess how various GA3 concentrations affected the performance of seedling growth and emergence in chilli. FGP and GRI had maximum value for T2, and all the treatments were highly significant for FGP and significant for GRI. In T3, the germination performance of the seed decreased drastically. MGT (MGT) decreased from control to T2 and then increased in T3. All three treatments were significantly different for MGT. SH and SVI had maximum values for T2, and all three treatments were significantly different from each other for SVI and highly significant for SH. The optimum concentration of GA3 as pretreatment of chilli seed will help better germination and healthy crop in turn.*

Keywords: Chilli Seeds, Germination, Gibberellic Acid (GA3), Dormancy, Seedling Growth, Seed Vigor, Concentration

Introduction

Chilli is a vegetable crop that belongs to the family Solanaceae. It has a somatic chromosome constitution as 2n=24 (Jha and Bhowmick, 2021). Gibberellic acid (GA3) is a phytohormone needed in minute quantity to accelerate plant growth and development. GA3 helps in increasing plant height, shoot, and root weight of the plant (Ghani et al., 2021; Thakur et al., 2022). GA3 is also used for the promotion of fruit sets in some fruits and vegetable production and can increase yields to four times (Bons and Kaur, 2020; Suman et al., 2017).

Seed germination is one of the basal concerns for getting optimal yield from any crop, including chilli (Singh and Rathore, 2021). Numerous studies have previously been carried out to accomplish that goal because the germination capacity of chilli seeds is always influenced by physiological or endogenous dormancy (Junaidy and Shahruddin, 2022; Taylor, 2020). According to El-Keblawy (2017), seed dormancy is the temporary inability for a viable seed to germinate under favorable conditions because of certain seed features that hinder germination and cause germination to be delayed. This may result in yield loss at the end of crop (El-Keblawy, 2017).

Using GA3 solution to treat seeds before to sowing was one of the most effective methods to break seed dormancy. Still, scientists were hoping for a more effective GA3 concentration (Yuningsih and Wahyuni, 2015). Research was conducted by Debbarma et al., (2018) to examine how chili seeds and seedlings responded to various treatments of GA3 (Debbarma et al., 2018). The lower doses of GA3 showed superior reactivity in breaking dormancy for chilli seeds and vice versa.

Furthermore, in order to prevent potential toxicity due to over dose of GA3, it is need of the hour to determine exact dose to maximize germination and save the money. This study aims to assess the impact of different GA3 solution concentrations on the germination of seeds and the growth performance of seedlings in chili plants.

Methodology

The experiment was arranged in CRD (Completely randomized design. Two hundred and forty healthy capsicum annum (chili) seeds were divided into twelve labeled petri plates. Each of the four treatments, Control (To), 20 mg/L (T1), 70 mg/L (T2), and 100 mg/L (T3), and three replications. chilli seeds were soaked in different concentrations of GA3 i.e. Control (T^o), 20 mg/L (T1), 70 mg/L (T2) and 100 mg/L (T3) with three replications of each treatment at room temperature for 24 hours. The seed were then sown in the Patri plates having wet cotton in it. FGP Final germination percentage was calculated by taking mean of data collected daily from sowing to 21 days after sowing. 15 seedlings from each treatment were transplanted

to polythene bags to record data related to seedling growth. After 6 weeks of transplantation the seedling height and SVI (Seedling vigor index) was recorded for all plants. Data was analyzed through Analysis of variance by steel et al. through statistix 8.1. The following formulas are used to calculate the discussed parameters.

Final Germination percentage (%) = number of seeds germinate 21 days after sowing/total number of seeds sown in each Patri plate × 100

GRI (% per day) = G1/1 + G2/2 +· · ·+ Gx/x

Where G1 = germination % at first day, G2 is germination at 2nd day …… G21 germination at 21st day

MGT (day) = ∑ fx / ∑f

Where f = seeds germinated on day x

Plant height (cm): it was recorded from base to tip of seedling with the help of ruler.

SVI = Seedling length (cm) × Germination percentage.

Results & Discussion

The mean data of FGP and GRI is presented in Fig. 1 and 2, respectively. FGP (Final germination percentage) (77.44%) GRI (Germination rate index) (14.57) was maximum at 70 mg/L of GA3 (gibberellic acid). The FGP and GRI increased as the concentration of gibberellic acid increased from 20 mg/L to 70 mg/L (fig. 1). As the concentration of GA3 increased to 100 mg/L, the FGP and GRI reduced drastically. The results of ANOVA showed that different concentration of GA3 has highly significant (P = 0.006) different results from each for FGP. Moreover, different concentrations of GA3 have significant (P = 0.02) results for each GRI (Table 2).

Mean data of MGT is given in fig 3. MGT (Mean Germination Time) decreased as the concentration of gibberellic acid increased from 20 mg/L to 70 mg/L (fig. 1). As the concentration of GA3 increased to 100 mg/L, the MGT increased drastically. Moreover, different concentration of GA3 has significant (P = 0.04) different results from each for MGT (Table 2).

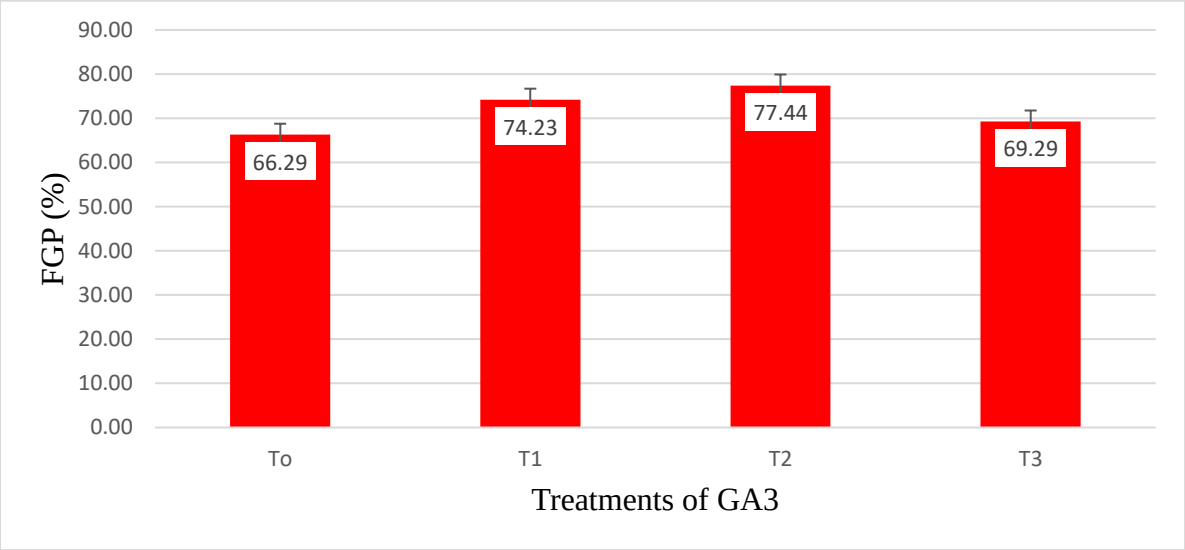

Fig 1 Mean performance of FGP of chilli seed at different treatments of Gibbrellic acid

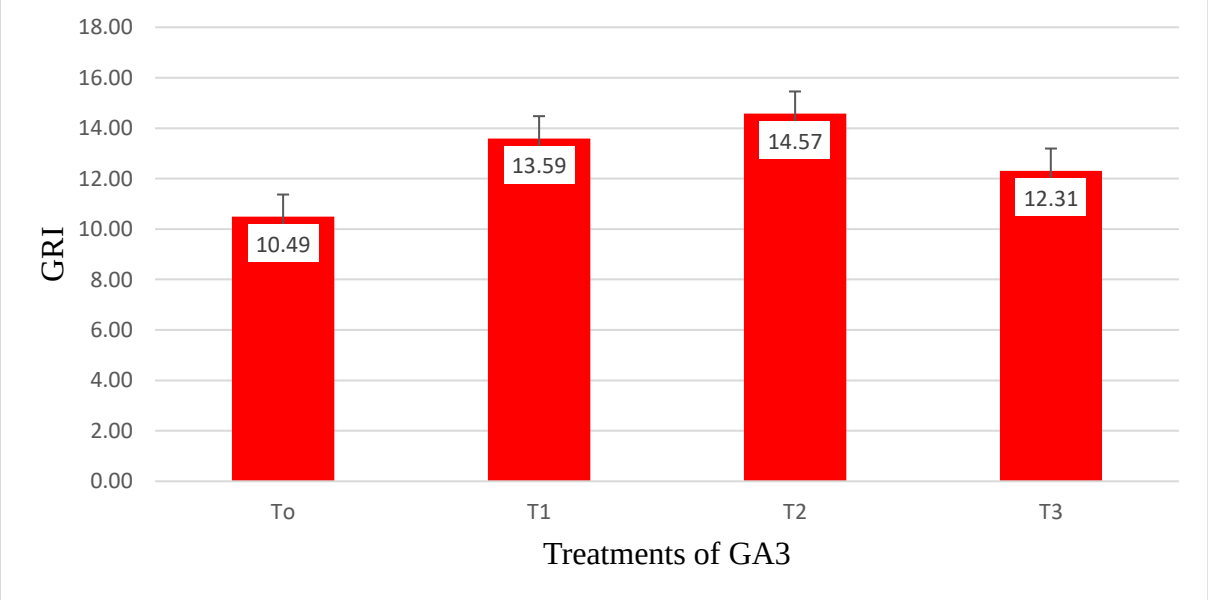

Fig 2 Mean performance of GRI of chilli seed at different treatments of Gibberellic acid

[Citation Ashraf, A., Shahid, S., Bibi, B., Mumtaz, M., Marri, J.K., Ullah, I., Hussain, T., Khadim, K., Arif, A., Faiz, A. (2024). Trends of germination in chilli seeds. *Biol. Clin. Sci. Res. J.*, **2024***: 1145*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1145]

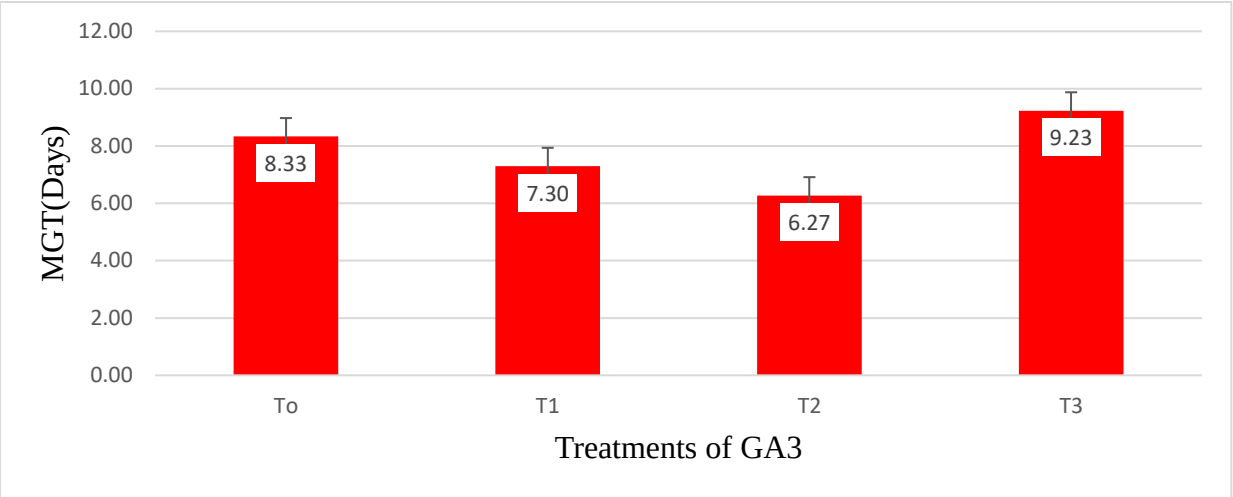

Fig. 3 Mean performance of MGT of chilli seed at different treatments of gibberellic acid

Mean data of SH and SVI is given in Fig 4.4 and 4.5 respectively. SH (Seedling height) (8.46 cm) SVI (Seedling vigor index) (12.48) was maximum at 70 mg/L of GA3 (gibberellic acid). The SH and SVI increased as concentration of gibberellic acid increased from 20 mg/L to 70 mg/L (Fig. 4.1). As concentration of GA3 increased to 100 mg/L the SH and SVI reduced drastically. The result s of ANOVA showed that different concentration of GA3 has significant (P = 0.03) different results from each for FGP. Moreover, different concentration of GA3 has highly significant (P = 0.005) different results from each for GRI (Table 4.2).

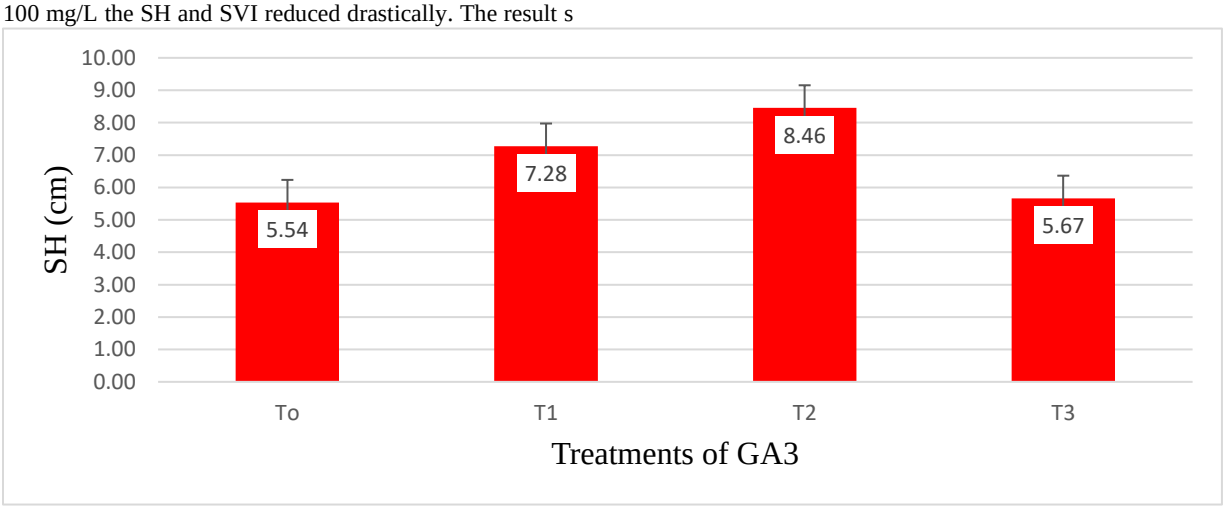

Fig. 4 Mean performance of SH of chilli seed at different treatments of Gibbrellic acid

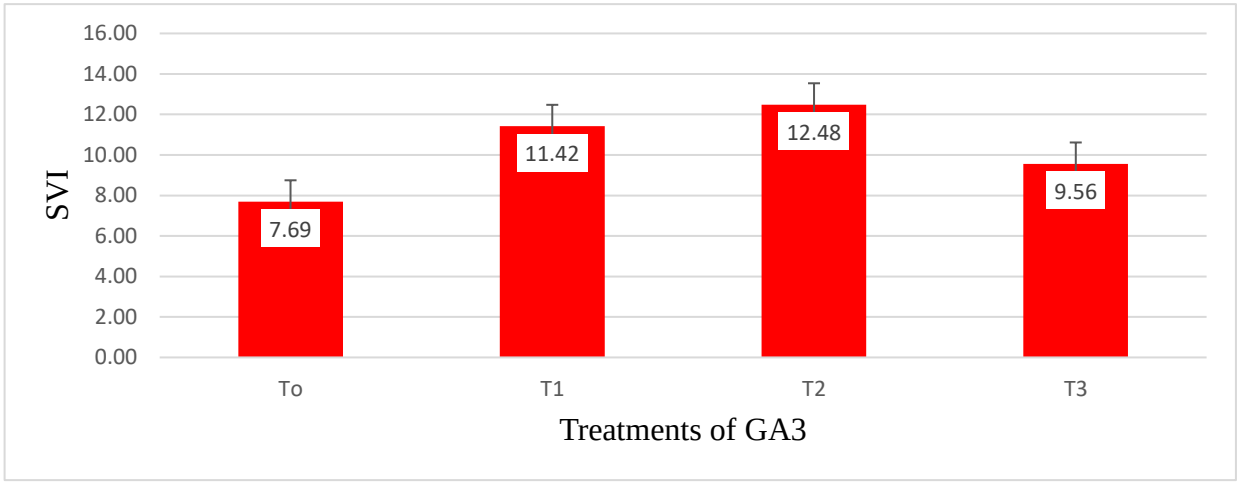

Fig. 5 Mean performance of SVI of chilli seed at different treatments of Gibberellic acid

[Citation Ashraf, A., Shahid, S., Bibi, B., Mumtaz, M., Marri, J.K., Ullah, I., Hussain, T., Khadim, K., Arif, A., Faiz, A. (2024). Trends of germination in chilli seeds. *Biol. Clin. Sci. Res. J.*, **2024***: 1145*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1145]

In the present research, some of the GA3 treatments (T3) showed an effect on the SVI variable that was quite equivalent to the control. Due to their high FGP and ultimately larger seedling length values, seeds treated with T2 among all showed marginally better seedling. Similar results were reported by Debbarma et al. (2018), who suggested that low SVI could potentially be caused by a higher GA3 concentration. In light of these results, of 25 to 75 mg/L may represent a potential optimum concentration of gibberellic acid for identifying the best chili seeds for germination and subsequent seedling establishment.

Table 1 Effect of different GA3 concentrations on germination and seedling growth of chilli seeds

Concentration of gibberellic acid	FGP	GRI	MGT	SH	SVI
Control (No GA)	66.29	10.49	8.33	5.54	7.69
20 mg/L	74.23	13.59	7.30	7.28	11.42
70 mg/L	77.44	14.57	6.27	8.46	12.48
100 mg/L	69.29	12.31	9.23	5.67	9.56
FGP: Final germination (% age) GRI: Germination rate index MGT: Mean germination time H: Seedling length SVI: Seedling vigor index					

Table 2 MSS and values for different germination and growth-related parameters of chilli seeds

Parameters	MSS	P value
FGP	74.36**	0.006
GRI	9.35*	0.02
MGT	4.92*	0.04
SH	5.83**	0.03
SVI	13.36**	0.005

Conclusion

The pre-seed treatment in chilli had a positive effect on germination percentage but this is limited to a certain level. Above an optimum level it drastically affects the germination % age and badly affect the growth of seedling later on.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
Funding
Not applicable

Author contribution
All authors contributed equally

Conflict of interest

The authors declared the absence of a conflict of interest.

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