

“Potential of Zinc glycinate and Calcium chloride on morphological and yield characters of Wheat (*Triticum aestivum* L)

Abstract

The present study entitled “**Potential of Zinc glycinate and Calcium chloride on morphological and yield characters of Wheat (*Triticum aestivum* L)**” was carried out to assess the effect of seed treatments during 2022-2023 to find the suitable seed treatment for wheat. Thirteen treatments along with control consists of Calcium chloride, Zinc glycinate and Calcium chloride & Zinc Glycinate in different concentrations, individually and combination as well. A Randomized Block Design (RBD) was used for statistical analysis. The main objectives of this experiment was to evaluate the influence of different concentrations of Zinc glycinate and Calcium chloride on morphological and yield parameters of Wheat and to determine the effective treatment for wheat. The results indicated that all treatments recorded significant variation for pre-harvest and post-harvest parameters that were studied. The treatment T₁₂ (Calcium chloride + Zinc glycinate-7%+7%) significantly recorded the higher values in Field emergence(95.55%), Plant height(93.13 cm), Number of tillers per plant(5.73), Spike length(15.18 cm), Seed yield per plant(16.37g) and Harvest Index(40.09%), in comparison with other treatments and lowest recorded in T₀(control). This study helps to find the best suitable seed treatment for wheat.

Keywords: Seed treatment, Zinc glycinate, CaCl₂, Field emergence and Harvest index.

INTRODUCTION:

Common wheat or Bread wheat (*Triticum aestivum* L) is most widely grown type wheat in India. It is a good source of carbohydrates, dietary fiber and essential nutrients such as Vitamin B and minerals like Iron and Magnesium but relatively low in certain amino acids such as Lysine and Protein sources. Wheat is used as a primary ingredient in a wide range of foods. It can be ground into flour to make products like Bread, Pastries, Cakes and Pasta. Wheat is best adapted to temperate regions with rainfall 30 cm to 90 cm. In 2022, world wheat production was 761 million tonnes, led by China, India, and Russia collectively providing 38% of the world total (**International wheat production statistics, 2022**). As per Second Advance Estimates for the agriculture year 2022-23, the wheat production in India is estimated at 112.18 million tons which is higher by 4.44 million tonnes than the production achieved during 2021-22. The total sown area under the wheat crop was 34.3 million hectares as of 2023. Wheat production in Uttar Pradesh is estimated at 9590.00 ha for the year 2022-23. (**Ministry of Agriculture and Farmers Welfare, 2022-23**). It has a good nutritional profile with 13% proteins, 40% Wet gluten content, 7% Yellow pigment content, 7% pentosans, 1.8% lipids. 1.8% ash. 20% reducing sugars and provides 314 Kcal/100g of food. Besides it also contains Calcium (37 mg/100 g), Nicotinic acid (5.4 mg/100 mg), Iron (4.1 mg/100 g), Thiamine (0.45 mg/100 g) and Riboflavin (**Fernando, 2014**).

Pre-sowing seed treatment refers to that treatments that are applied to seeds before they are planted in order to enhance their germination, growth and overall health to improve the crop establishment and yield potential. Some of that treatments are Zinc glycinate and Calcium chloride. Zinc glycinate is a chelated form of zinc, where zinc is bound to the amino acid glycine. In plants, zinc is an essential micronutrient that plays a vital role in various physiological processes and is required for proper growth, development, and overall health. Calcium chloride (CaCl_2) is a salt of calcium and chlorine and is widely used in various agricultural and horticultural practices as a source of calcium and as a means to manage specific plant responses. Calcium is one of the essential secondary nutrients required by plants. Through the pre-sowing treatment in the seed, one can enhance the quality of seeds. The seed can protect the stress which is caused by the abiotic stress and also produce equal germination, thus overall crop yields might be greatly enhanced. It is also reported that seed hardening can be useful to develop the rapid and uniform germination and emergence of the seeds and it also increases the seeds tolerance to adverse environmental conditions (**Ananthi 2017**).

MATERIALS AND METHODS:

Description of experimental site:

This experiment was conducted in *Rabi* season of 2022 in field experimentation of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (25 24' N, 81 05' E). The soil was of sandy clay loam in texture, p^H of water is 7.1, Organic matter (0.50%) and Electrical conductivity (0.37 dsm⁻¹). The experimental material for present investigation comprised of 13 treatments was conducted in Randomized Block Design (RBD) with 3 Replications.

Preparation of treatments with Zinc glycinate: Seeds were soaked in four concentrations of Zinc Glycinate; 1% solution was prepared by dissolving 1 gram in 100 ml of distilled water. 2%, 5% and 7% solutions were prepared by dissolving 2 grams, 5 grams and 7 grams in 100 ml of distilled water respectively. The seeds were soaked for 3 hours and then it is allowed to dried under shade condition for a period of 3 hours and finally it dried under sun condition which bring back to its original moisture condition.

Preparation of treatments with Calcium chloride: Seeds were soaked in four concentrations of Calcium chloride; 1% solution was prepared by dissolving 1 gram in 100 ml of distilled water. 2%, 5% and 7% solutions were prepared by dissolving 2 grams, 5 grams and 7 grams in 100 ml of distilled water respectively. The seeds were soaked for 3 hours and then it is allowed to dried under shade condition for a period of 3 hours and finally it dried under sun condition which bring back to its original moisture condition.

The following are the treatments:

T₀-Control

T₁-Calcium chloride(1%)-3 hours

T₂-Calcium chloride(2%)-3 hours

T₃-Calcium chloride(5%)-3 hours

T₄-Calcium chloride(7%)-3 hours

T₅-Zinc glycinate(1%)-3 hours

T₆-Zinc glycinate(2%)-3 hours

T₇-Zinc glycinate(5%)-3 hours

T₈-Zinc glycinate(7%)-3 hours

T₉-Calciumchloride+Zinc glycinate(1% + 1%)-3 hours

T₁₀-Calciumchloride+Zinc glycinate (2% + 2%)-3 hours

T₁₁-Calciumchloride+Zinc glycinate(5% + 5%)-3 hours

T₁₂-Calciumchloride+Zinc glycinate(7% + 7%)-3 hours



Fig.1 Pre-sowing seed treatment with different concentrations of Calcium chloride and Zinc glycinate

Seed sowing and cultural practices:

Wheat variety AAIW-42 seeds were provided by Department of Genetics and Plant Breeding, Naini Agricultural institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh) India. Seeds were sown in soil at the depth of 3-5 cm with spacing of 30× 10 cm² @ 100 kg/ha. Total 30 seeds were sown per treatment in 3 lines in each replication. Irrigation given weekly basis in such a way that the moisture content remained > 80% and 3 hoeing were given to keep plots free from weeds. Individual treatments were harvested with the help of sickles and threshed to separate the seeds. Wheat crop taken 110 days for harvesting from 25 November 2022 to 15 March 2023. In the present study, data of the following pre-harvest and post- harvest parameters data is recorded:

1. Field Emergence (%).
2. Plant height(cm).

3. Number of tillers per plant.
4. Days to 50% flowering.
5. Spike length(cm).
6. Days to Maturity.
7. Seed yield per plant(g).
8. Harvest index (%).

RESULTS AND DISCUSSION

Results from the experiment revealed that different concentrations of pre-sowing seed treatment influenced the growth and yield parameters. The present study revealed that treatment T₁₂- Calcium chloride(7%) along with Zinc glycinate(7%) showed that maximum growth and yield attributing traits in Wheat. The mean values, standard error mean, standard error of difference, the critical difference at 5 % level of significance and coefficient of variation with 13 treatments along with 8 parameters were represented in Table-1, which revealed a wide range of variation for all the traits studied. The mean performances of different priming treatments with respect to different attributes is described as under:

Morphological attributes: As per the data mentioned in the Table-1. the maximum field emergence was found in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 95.55% which is followed by treatment T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 94.44% and minimum was observed in control treatment with mean value of 84.44%. Calcium and Zinc treated seeds withstand the stress which is caused by the abiotic stress and also produce equal germination, useful to develop the rapid and uniform germination and emergence of the seedlings (**Ananthi 2017**). Maximum plant height after 90 days in wheat was observed in the treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 93.13 cm which is followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 92.34 cm and minimum was observed in control treatment with mean value of 85.04 cm. Calcium chloride (CaCl₂) plays a crucial role in maintaining plant cell structure and its function. It is an integral component of the middle lamella, which holds plant cell walls together, providing strength and rigidity to the plant's tissues that increases the plant height rapidly (**Ananthi 2017**). Maximum number of tillers were found in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 5.73 which is

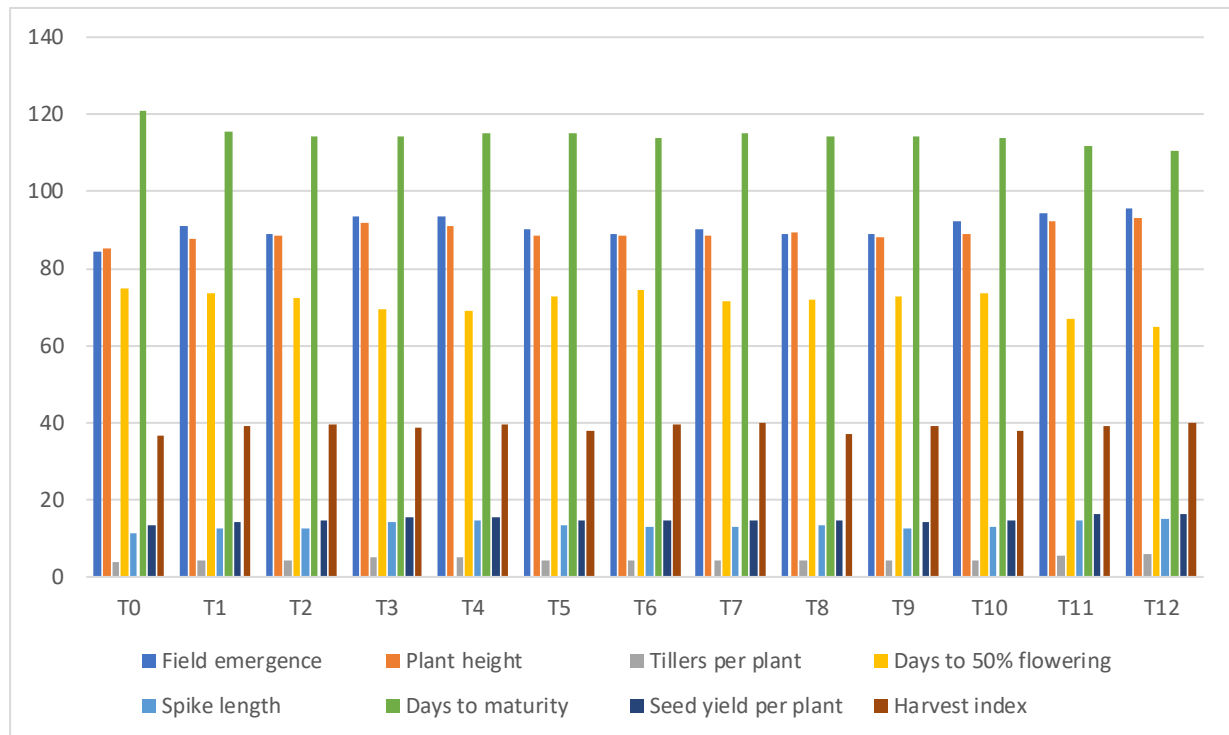
followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 5.46 and minimum was observed in control treatment with mean value of 4. As per the data shown in the Table-1 minimum days required for 50 % flowering were observed in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 65 days which is followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 67 days but control treatments takes 75 days for 50 % flowering which is highest when compared with other treatments. Zinc is an essential micronutrient that plays a vital role in various physiological processes and is required for proper growth and causes for early flowering in wheat. Maximum spike length was observed in treatment T₁₂-Calcium chloride 7% and Zinc glycinate 7% with mean value of 15.18 cm which is followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 14.76 cm and minimum was observed in control treatment with mean value of 11.27 cm. As per the data shown in the Table-1 minimum days required for maturity of wheat crop were observed in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 110.6 days which is followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 111.60 days but control treatment takes 121.06 days for maturity which is highest when compared with other treatments. Zinc is a crucial component that enhances various enzymes which play essential roles in various metabolic processes like Auxin (plant growth hormone) synthesis and Carbon metabolism which reduces the maturity time for wheat.

Yield attributes: As per the data shown in the Table-1 maximum seed yield per plant was observed in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 16.37 g which is followed by T₁₁- Calcium chloride 5% and Zinc glycinate 5% with mean value of 16.11 g and minimum was observed in control treatment with mean value of 13.22 g. Maximum Harvest index was observed in treatment T₁₂- Calcium chloride 7% and Zinc glycinate 7% with mean value of 40.09% which is followed by T₇-Zinc glycinate(5%) with mean value of 40.01% and minimum was observed in control treatment with mean value of 36.66%.

Table-1. The mean values of different pre-sowing seed treatment in wheat

S.No.	Treatments	Field emergence (%)	Plant height (cm)	No.of tillers per plant	Days to 50% flowering	Spike length (cm)	Days to maturity	Seed yieldper plant(g)	Harvest index(%)
1	T ₀	84.44	85.04	4.00	75.00	11.27	121.06	13.22	36.66
2	T ₁	91.22	87.69	4.20	73.66	12.70	115.53	14.40	39.00
3	T ₂	88.88	88.49	4.33	72.33	12.66	114.06	14.46	39.50
4	T ₃	93.32	91.88	4.93	69.33	14.36	114.26	15.56	38.74
5	T ₄	93.33	91.12	5.06	69.00	14.48	115.26	15.66	39.60
6	T ₅	89.99	88.47	4.13	72.66	13.26	115.13	14.61	38.02
7	T ₆	88.88	88.68	4.26	74.33	12.86	114.00	14.70	39.61
8	T ₇	90.11	88.68	4.13	71.33	12.80	115.06	14.64	40.01
9	T ₈	88.88	89.52	4.20	72.00	13.48	114.46	14.64	37.15
10	T ₉	88.99	88.07	4.13	72.66	12.58	114.06	14.21	39.16
11	T ₁₀	92.22	88.92	4.06	73.66	12.77	113.93	14.82	37.87
12	T ₁₁	94.44	92.34	5.46	67.00	14.76	111.66	16.11	39.28
13	T ₁₂	95.55	93.13	5.73	65.00	15.18	110.60	16.37	40.09
Grand Mean		90.79	89.38	4.51	71.14	13.38	114.54	14.88	38.82
SE(d)		1.74	1.36	0.23	1.74	0.28	0.83	0.31	0.68
SE(m)		1.23	0.61	0.16	1.23	0.20	0.58	0.21	0.48
C.D(0.05 <i>p</i>)		3.59	1.78	0.48	3.60	0.59	1.71	0.64	1.41
C.V.		2.35	1.18	6.40	2.99	2.66	0.88	2.55	2.16

Fig.2 Bar graph representing the mean values of different presowing seed treatments in Wheat



CONCLUSION:

From the present investigation it is concluded that Calcium chloride and Zinc glycinate that plays a vital role in various physiological processes and is required for proper growth and causes for early flowering and early maturity in wheat. Among the various seed treatments, treatment with Calcium chloride 7% along with Zinc glycinate 7% of 3 hours duration showed significantly maximum in all attributes which is followed by Calcium chloride 5% along with Zinc glycinate 5%. Treatment T₁₂ shows highest field emergence(95.55%), plant height(93.13 cm), tillers per plant(5.73), spike length(15.18 cm), seed yield per plant(16.37 g) and harvest index(40.09%) and taken very less time for 50 % flowering and maturity of crop when compared with all other treatments in this experiment. It is concluded that from this experiment Calcium chloride 7% along with Zinc glycinate 7% is better performed seed treatment.

Acknowledgement:

Authors are thankful to all the faculty members of the Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India for providing the encouragement and support during experiment.

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