Comparative Evaluation of the Effects of Pre-Sowing Treatments on the Germination and Growth Parameters of *Zea Mays* Linn

ABSTRACT

A comparative study on the effects of pre-sowing treatments on the germination and growth of *Zea mays* was carried out by subjecting the seeds to three treatments at different durations before sowing. The treatments used include; soaking in 30% H_2SO_4, vernalization and soaking in water (hydotreatment). Soil was filled in 160 polyethene bags of 10 kg each. Five polyethene bags were used for each replicate. With this arrangement, 16 replicates were gotten for the plant according to the treatment and duration placement. Parameters such as germination percentage, plant height, and stem girth as well as leaf area were collected and analyzed using mean, variance, standard deviation, variance of the mean, standard error and confidence limit. The results of the analysis showed that the various treatments and the duration significance on percentage germination and growth parameters of *Zea mays* seeds. Data presented in table 1-14 showed the various treatments and the duration significance on percentage germination of *Zea mays* seeds. The result showed that the treatment of seeds before cultivation increased the percentage germination in *Zea mays* when compared with the control replicate. The results revealed the height readings of different treatment sources and treatment durations and how significantly it affected the height of *Zea mays*. It was also observed that leaf Area and stem girth significantly increased in different treatment methods and durations as seen in treatment of *Zea mays*. From this research, it was observed that seed treatment resulted in early germination and high growth strength; hence seed treatment with any of the treatments will suffice in giving a better seed performance but for the sake of availability and accessibility of the treatments, hydro-treatment is most recommended.

KEYWORDS: Germination, Growth, Vernalization, Sulphuric acid, Maize, Soak, Hydrotreatment.

INTRODUCTION

Over the past two decades seed enhancement through seed treatment has led to great improvements in a grower's ability to routinely achieve this goal in both the field and greenhouse. Numerous vegetable and ornamental crop species have been treated successfully. In order to maintain a superior product, seed companies have to maintain seed quality and longevity in the treated seed. Rapid and uniform field emergences are two essential prerequisites to increase yield, quality, and ultimately profits in crops [1]. Uniformity and percentage of seedling emergence of direct-seeded crops have a major impact on final yield and quality. Slow emergence results in smaller plants and seedlings, which are more vulnerable to soil-borne diseases [1]. Extended emergence periods predispose the planting bed to deterioration and increased soil compaction, particularly under adverse environmental conditions [1].

Poor germination is a common phenomenon at sub-optimal temperatures, which is a great concern of growers that grow seedlings in late winter and early spring in the Mediterranean region. Optimum seed germination and seedling emergence occur at relatively high temperatures (20–30°C) for several species (e.g. tomato, eggplant, bean, watermelon, cucumber and melon) [1].

Nowadays, various seed treatment techniques have been developed, including hydrotreatment (soaking in water), halotreatment (soaking in inorganic salt solutions), osmotreatment (soaking in solutions of different organic osmotica), thermotreatment (treatment of seed with low or high temperatures), solid matrix treatment (treatment of seed with solid matrices), and biotreatment (hydration using biological compounds) [2]. Each treatment has advantages and disadvantages and may have varying effects depending upon plant species, stage of plant development, concentration/dose of treatment agent, and incubation period.

Several studies on seed germination and seed emergence revealed the beneficial effects of seed treatment by several ways (heat, smoke, soaking, leaching, temperature, scarification and NaCl salinity) [3]. Solid matrix treatment improved germination of hot pepper seed by 10–16 % depending on temperature, and this was effect enhanced when the Symmetric Multiprocessing (SMP) was followed by halotreatment and osmotreatment [4]. Moreover, hydrotreatment (48 h) for tomato and sand matrictreatment (80 % water holding capacity, 3 days) for eggplant and chilli were established as best methods of treatment capable of improving seed vigour [5]. Previous studies revealed the beneficial effects on seed germination and seedling emergence of treatment (–1.5 MPa KH_2PO_4 solution for 20 h

at 15 °C, in darkness) lettuce seeds following high temperature (35 °C) and/or incorporating plant growth regulators (putrescine or 1-aminocyclopropane1-carboxylic acid (ACC) [1].

Maize production based on FAO documents [6] accounts for 2.8 % of total cereals production in Iran, with 1.6 million tones grain production from 0.25 million hectares cultivated land, in spite of the fact that the production of hybrid seed is too low. Breeders produce hybrid maize seeds by cross-pollinating inbred lines. Commercial hybrid production involves planting male and female inbred lines in separate rows in an isolated field where possibility of foreign pollen contamination is rare. For success in hybrid seed production, synchronization between anthesis and silking of the parental inbred lines is essential [7]. With regard to this point that maize is a protandrous plant (anthesis is earlier than silking), it seems that synchronization can be achieved by delaying the sowing date of male lines in company with using some pre-sowing seed invigoration treatments to improve germination and emergence.

Technology that progress seed germination and stand establishment would enable the parental plants to capture more soil moisture, nutrients, solar radiation, and help to attain high synchronization of the reproductive stages of each parents and mature before the occurrence of cool stress in fall [8]. Therefore, seed invigoration treatments have been developed to improve seed performance during germination and seedling early growth.

The general purpose of seed treatment is to hydrate partially the seed to a point where germination processes are initiated but not completed. Most treatments involve imbibing seed with restricted amounts of water to allow sufficient hydration and advance of metabolic processes but preventing the protrusion of the radicle. Treated seeds usually would exhibit rapid germination when absorb water under field conditions [2].

Maize (*Zea mays*) commonly known as corn, is a large grain plant from the family Poaceae was first domesticated by indigenous people in Mexico about 10,000 years ago. The leafy stalk of the plant produces separate pollen and ovuliferous inflorescences or ears which are fruits, yielding kennels often known as seed. Maize seed is often used in cooking as a starch. The aim of this study was to determine the effect of pre-sowing treatments (H_2SO_4, vernalization and water) on the germination and growth parameters of *Zea mays* in order to foster increased production and sustainablity.

MATERIALS AND METHODS

Study Area

This research was both a laboratory and field work investigation. Seed soaking was conducted in the laboratory of biotechnology, Ebonyi State and the field aspect of this experiment was carried out at the Ebonyi State University research field, located at Presco Campus. The area is at longitude 6°20' N 8°06' E and latitude 6.333 °N 8.1000 °E. The mean minimum and maximum temperature ranges from 25 °C to 38 °C. The area has an average altitude of 160 mm above sea level with an average rainfall of 720 mm.

Sample Collection

Two hundred grams (200g) of maize seeds seed was collected from Abakpa main market, Abakaliki, Nigeria.

Viability Test

A viability test was carried out on the seeds by soaking them in water for 3 min. The non viable seeds floated and were discarded. The viable seeds were later dried for planting.

Seed Treatment

About 135 seeds per treatment of each crop were soaked using a glass beaker. The seeds were re-weighed and sowed out in the soil prepared. Each experimental unit consisted of soil contained in a 1L black polythene bag.

The seeds were treated based on the levels of factors utilized in the study. Each seed lot per treatment was replicated five times. The vernalization treatments included the following: V_1= seeds treated by vernalization for 12 h; V_2 = seeds treated by vernalization for 24 h, V_3 = seed treated by vernalization for 36 h; V_4 = seeds treated by vernalization for 48 h, V_5 = seeds treated by vernalization for 72 h.

S= The seeds treated by soaking in water method was done as follows; S_1= seeds treated by soaking in water for 12 h; S_2 = seed treated by soaking in water for 24 h; S_3 = seed treated by soaking in water for 36 h; S_4 = seeds treated by soaking in water for 48 h; S_5 = seeds treated by soaking in water for 72 h.

The scarification or sulphuric acid seed treatment technique was done as follows: R_1 = seeds treated with sulphuric acid for 10 min; R_2 = seed treated with sulphuric acid for 20 min; R_3 = seed treated with sulphuric acid for 30 min; R_4 = seeds treated with sulphuric acid for 40 min; R_5 = seeds treated with sulphuric acid for 50 min. Two factors were studied in this experiment as:

Factor A: Three levels of sources of seed treatment.

i. Distilled water (DW).
ii. Laboratory refrigerator.
iii. 30 % solution of sulphuric acid (dissolved).

Factor B: Five levels of seed soaking periods utilized were 12 h, 24 h, 36 h and 72 h.

The control experiment was kept as untreated seeds. After treatment in different sources for various durations, the seeds were air dried at room temperature for at least 3 min close to original moisture level.

Field clearing and planting
The field was cleared manually by means of a cutlass. Soil was dug using a hoe. The dunged soil was filled in 160 polyethene bags of 10 kg each. Five polyethene bags each were kept as one replicate. With this arrangement, 16 replicates were gotten for each plant according to the treatment and duration placement. The bags were properly labeled using masking tape.

Germination and Measurement
Percentage germination was determined after one week of planting. It was done using the formula;

$$\text{Percentage germination} = \frac{\text{no of germinated seeds}}{\text{total seeds planted}} \times \frac{100}{1}$$

Percentage germination was taken for all the replicates. The measurements of the plant height and leaf area were measured using meter rule while the plant girth was measured using the combination of thread and meter rule.

Plant height was measured using the meter rule by measuring the distance between the upper part of the photosynthetic area and the ground level.

The leaf area was determined using the non destructive length and width; with the formula LA= Length × Width.

Plant girth was measured by using a thread to tie around the body of the plant. The length of the thread was then measured using a meter rule.

Total plant height, plant girth and leaf area was a sum total of the 7 weeks data collected.

Statistical Analysis
Data collected were statistically analyzed using mean, variance, and standard deviation, as well as variance of the mean, standard error and confidence limit.

RESULT
Percentage Germination for Control Experiment
Table 1: Describes the percentage germination for control experiment in *Zea mays.*

Table 1: Percentage Germination for Control Experiment

Plant type	Treatment	Number of replicate	Total Number of Germination	Total number of seed sown	%Germination
Zea mays	Control	5	18	25	72 %

Table 2: Describes the plant height, plant girth, and plant leaf area for control experiment in *Zea mays*, the result showed that the plant height confidence interval ranges between (7.48 ± 108.74), plant girth confidence interval ranges between (2.28 ± 6.15) and plant leaf area confidence interval ranges between (20.52 ± 354.48).

Table 2: Plant Height, Plant Girth and Leaf Area of *Zea mayz* Control Experiment

Parameters	Total height (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
Plant Height	290.56	58.11	57.77	57.92	25	50.63	7.48±108.74
Plant Girth	16.42	3.28	3.28	3.23	1	2.87	2.28±6.15
Leaf Area	937.5	187.5	190.51	188.19	85	166.98	20.52±354.48

Table 3: Shows the result of the average germination percentage for H_2SO_4 30 % recorded in *Zea mays* showing the highest germination percentage (92 %) treated for 30 minutes and the lowest percentage germination (56 %) treated for 50 minutes.

Table 3: Percentage germination for *Zea mays* treated with H_2SO_4 (Dilute) 30 %

Plant type	Treatment	Duration	No of replicate	Total no seeds sown	Total no of seeds germinated	% germination
Zea mays	H_2SO_4	10 mins	5	25	22	88 %
Zea mays	H_2SO_4	20 mins	5	25	19	76 %
Zea mays	H_2SO_4	30 mins	5	25	23	92 %
Zea mays	H_2SO_4	40 mins	5	25	20	80 %
Zea mays	H_2SO_4	50 mins	5	25	14	56 %

Table 4: Describes the result of the percentage germination for vernalization (5-10 ^oC) showing the highest percentage germination (92 %) treated for 12 hours and lowest percentage germination (40 %) in the treated for 48 hours.

Table 4: Percentage germination for *Zea mays* treated with vernalization (5 - 10 ^oC)

Plant type	Treatment	Duration	No of replicate	Total no seeds sown	Total no of seeds germinated	% germination
Zea mays	Vernalization	12 hours	5	25	23	92 %
Zea mays	Vernalization	24 hours	5	25	18	72 %
Zea mays	Vernalization	36 hours	5	25	19	76 %
Zea mays	Vernalization	48 hours	5	25	10	40 %
Zea mays	Vernalization	72 hours	5	25	12	48 %

Table 5: Describes the result of the percentage germination for soaking in water (distilled) revealed the highest percentage germination (96 %) soaked for 12 hours and lowest percentage germination (40 %) soaked for 72 hours.

Table 5: Percentage germination for *Zea mays* treated with hydrotreatment (distilled)

Plant type	Treatment	Duration	No of replicate	Total no seeds sown	Total no of seeds germinated	% germination
Zea mays	Hydrotreatment	12 hours	5	25	24	96 %
Zea mays	Hydrotreatment	24 hours	5	25	15	60 %
Zea mays	Hydrotreatment	36 hours	5	25	13	52 %
Zea mays	Hydrotreatment	48 hours	5	25	17	65 %
Zea mays	Hydrotreatment	72 hours	5	25	10	40 %

Table 6: describes the result of the plant height reading for H_2SO_4 (30 %) in *Zea mays* showing the highest mean value (56.3) in 40 minutes and lowest mean value (50.11) in 50 minutes.

Table 6: Height reading for *Zea mays* treated with H_2SO_4 (30 %) dilute

Replicates	Duration	Total height (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	10 minutes	272.52	54.50	1.87	0.87	0	1.64	52.86±56.14
R2	20 minutes	265.82	53.16	0.97	0.23	0	0.85	52.31±54.01
R3	30 minutes	266.26	53.25	0.79	0.16	0	0.69	52.56±53.94
R4	40 minutes	277.88	56.3	12.37	38.23	5	10.84	45.5±67.44
R5	50 minutes	251.04	50.11	4.92	6.05	2	4.31	45.8±54.42

Table 7 describes the result of the plant height readings for *Zea mays* treated by vernalization between (5^oC to 10^oC), revealed the highest mean value (44.81) in 48 hours and the lowest mean value (43.51) in 36 hours.

Table 7: Height reading of *Zea mays* treated by vernalization between (5^oC to 10^oC) of temperature

Replicates	Duration	Total height (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	12 hours	217.68	43.54	1.15	1.33	0	0.01	43.53±43.55
R2	24 hours	244.05	44.81	3.87	14.96	1	3.39	41.42±48.2
R3	36 hours	227.56	43.51	4.81	23.18	2	4.22	39.29±47.73
R4	48 hours	223.72	44.74	1.19	1.41	0	1.04	43.7±45.78
R5	72 hours	218.04	43.61	1.35	1.82	0	1.18	42.43±44.79

Table 8 describes the result of plant height readings of *Zea mays* treated by soaking in water method (distilled) recorded the highest mean value (47.23) in *Zea mays* treated for 36 hours and the lowest mean value (42.78) in *Zea mays* treated for 72 hours.

Table 8: Height Readings of *Zea mays* treated with hydrotreatment method (distilled)

Replicates	Duration	Total height (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	12 hours	227.74	45.55	1.04	1.07	0	0.91	44.64±46.46
R2	24 hours	230.72	46.14	1.12	1.24	0	0.98	45.16±47.12
R3	36 hours	238.14	47.23	1.1	1.22	0	0.97	46.26±48.2
R4	48 hours	213.88	42.78	1.56	2.43	0	1.37	41.41±44.15
R5	72 hours	231.58	46.32	0.57	0.32	0	0.5	45.82±46.82

Table 9 below shows the result of Girth Readings of *Zea mays* treated H_2SO_4 (30 %) recording the highest mean value (5.72) in *Zea mays* treated for 40 minutes and the lowest mean value (5.24) in *Zea mays* treated for 10 minutes.

Table 9: Plant Girth Readings of *Zea mays* treated with H_2SO_4 (30 %) dilute

Replicates	Duration	Total Girth (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	10 minutes	26.2	5.24	0.16	0.026	0	0.14	5.1±5.38
R2	20 minutes	28	5.72	0.08	0.01	0	0.07	5.65±5.79
R3	30 minutes	27.7	5.54	0.31	0.1	0	0.27	5.27±5.81
R4	40 minutes	26.64	5.33	0.16	0.03	0	0.14	5.19±5.47
R5	50 minutes	29.08	5.43	0.25	0.06	0	0.22	5.21±5.65

The table below showing the result of Girth Readings of *Zea mays* treated by Vernalization recorded the highest (4.05) and the lowest mean value (3.55) in *Zea mays* treated for 24 hours and 48 hours respectively.

Table 10: Plant Girth Readings of *Zea mays* treated by Vernalization between (5 – 10 ^oC) of temperature

Replicates	Duration	Total Girth (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	12 hours	18.58	3.72	0.11	0.01	0	0.09	3.63±3.81
R2	24 hours	20.26	4.05	0.14	0.02	0	0.12	3.93±4.17
R3	36 hours	18.46	3.69	0.08	0.01	0	0.07	3.62±3.76
R4	48 hours	17.74	3.55	0.34	0.11	0	0.29	3.26±3.84
R5	72 hours	19.32	3.86	0.22	0.05	0	0.2	3.66±4.06

The result of the Plant Girth Readings of *Zea mays* treated with soaking in water method (distilled) showed the highest mean value (4.22) in *Zea mays* treated for 24 hours and the lowest mean value (3.83) in *Zea mays* treated for 72 hours.

Table 11: Plant Girth Readings of *Zea mays* treated with hydrotreatment method (distilled)

Replicates	Duration	Total Girth (cm)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval

R1	12 hours	20.42	4.08	0.06	0.00	0	0.05	4.03±4.13
R2	24 hours	21.12	4.22	0.13	0.02	0	0.11	4.11±4.33
R3	36 hours	21.54	4.4	0.68	0.46	0	0.59	3.81±4.99
R4	48 hours	20.92	4.18	0.45	0.2	0	0.39	3.79±4.57
R5	72 hours	19.14	3.83	0.1	0.01	0	0.08	3.75±3.91

The Leaf Area Readings of *Zea mays* treated with H_2SO_4 (30 %) dilute shown in the table below revealed the highest mean value (275.3) in *Zea mays* treated for 10 minutes and the lowest mean value (216.63) in *Zea mays* treated for 30 minutes.

Table 12: Leaf Area of *Zea mays* treated with H_2SO_4 (30 %) dilute.

Replicates	Duration	Total Leaf area (cm^2)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	10 minutes	1376.49	275.3	30.46	927.89	13	26.7	248.6±302.0
R2	20 minutes	1129.33	225.87	8.72	76.09	3	7.65	218.22±233.52
R3	30 minutes	1083.12	216.63	3.02	9.15	1	2.65	213.28±219.28
R4	40 minutes	1101.62	220.33	3.34	11.14	1	2.93	217.4±223.26
R5	50 minutes	1251.74	250.35	19.68	387.23	8	17.25	233.1±267.6

The result of the Leaf Area of *Zea mays* treated by Vernalization between (5 ^oC to 10 ^oC) of temperature as shown in the table below recorded the highest mean value (250.18) in *Zea mays* treated for 36 hours and the lowest mean value (228.62) in *Zea mays* treated for 12 hours.

Table 13: Leaf Area of *Zea mays* treated by Vernalization between (5 ^oC to 10 ^oC) of temperature

Replicates	Duration	Total Leaf area (cm^2)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	12 hours	1143.06	228.62	19.67	386.99	8	17.24	211.38 ± 245.86
R2	24 hours	1092.51	218.5	20.14	405.66	9	17.65	200.85 ± 236.15
R3	36 hours	1250.87	250.17	20.17	406.63	9	17.68	232.49 ± 267.85
R4	48 hours	1162.15	232.43	17.87	319.22	7	15.66	216.77 ± 248.09
R5	72 hours	1196.74	239.35	8.47	71.7	3	7.42	231.93 ± 246.77

The Leaf Area Readings of *Zea mays* treated with soaking in water method (distilled) as shown in the table below revealed the highest mean value (236.61) in *Zea mays* soaked for 36 hours and the lowest mean value (210.21) in *Zea mays* soaked for 12 hours.

Table 14: Leaf Area of *Zea mays* treated with hydrotreatment method (distilled)

Replicates	Duration	Total Leaf area (cm^2)	Mean	Standard deviation	Variance	Standard error	Confidence limit	Confidence interval
R1	12 hours	1051.08	210.21	34.61	1197.91	15	30.34	179.87±240.55
R2	24 hours	1160.13	232.03	24.53	601.73	10	21.5	210.53±253.53
R3	36 hours	1183.06	236.61	18.39	338.17	8	16.12	220.49±252.73
R4	48 hours	1131.42	226.28	23.49	551.96	10	20.59	205.69±246.87
R5	72 hours	1159.4	231.88	7.9	62.43	3	6.93	224.95± 238.81

DISCUSSION

The effects of pre sowing treatment on the germination and growth development of the seeds of *Zea mays* was observed under three treatments which includes soaking in H_2SO_4, vernalization and hydrotreatment at different time intervals. Data presented in table 2-14 showed the various treatments and the duration significance on percentage germination and morphometric data of *Zea mays* seeds. Maximum (92 %) percentage germination was recorded for *Zea mays* in which seeds were soaked in H_2SO_4 for 30mins while minimum (56 %) percentage germination was recorded for seed soaked in H_2SO_4 for duration of 50 minutes. Maximum (92 %) percentage germination was recorded for *Zea mays* in which seeds were treated with vernalization for 12 hours and minimum (40 %) percentage germination for *Zea mays* treated with vernalization for 48 hours. Also, maximum (96 %) percentage germination was recorded for *Zea mays* in which seeds were soaked in distilled water for 12 hours and minimum of (40 %) percentage germination for *Zea mays* soaked in distilled water for 72 hours. While in the control specimen, (72 %) percentage germination was recorded for *Zea mays.* The result showed that the treatment of seeds before cultivation increased the percentage germination in *Zea mays* when compared with the control replicate. Basra *et al.* found that treatment of corn seed using polyethylene glycol or potassium salts (K_4HPO_4 or KNO_3) resulted in accelerated germination at a chilling germinator (10°C). Maize seed soaked by 2.5 % KCl for 16h

reduced coleoptile and radicle length, while seed soaked in 20 ppm GA_3 for 30 min improved some germination traits, but could not affect grain yield [8]. Significant improvement in field emergency, seedling character also high synchronization of silking and anthesis for maize genotype was achieved through the hyrotreatment for 24 hours [7].

Earlier studies showed that the success of seed treatment is influenced by the complex interaction of factors including plant species, water potentiality of the treatment agent, duration of treatment, temperature, seed vigor and dehydration, and storage conditions of the treated seed [10]. Treatment allows some of the metabolic processes to occur necessarily for germination before actual germination to get start [11]. Treatment triggers the synthesis or activation of some enzymes that catalyze the mobilization of storage reserves in seed. But it is important to regulate the exposure of the seeds to a particular treatment so as not to destroy the seed and as well get a good result, hence the exposure of seeds to different treatments in this study at various durations. Although, soaking in acid for 30 min and vernalization treatments gave a high germination percentage of 92%, yet soaking in water for 12 h gave a slightly higer germination percentage. Therefore, considering the availability and accessibility of water when compared to other treatments used in this study, it can be proffered as a suitable method of seed treatment for enhanced performance. A research carried out by Muhammad and Amusa [12] on seed of *T. indica* showed that the highest germination percentage of 78.8 was recorded when seeds were treated with 50 % sulphuric acid for 60 min. Results also indicated that seed germination increased with increasing water temperature and soaking period. Significant differences were also found to exist among all the treatments. More so, Duguma *et al*. [13] reported high percentage germination in seeds of *Leucaenia leucocephala* and *Acacia nilotica* with increasing ratio of seed weight to hot water volume.

Muhammad and Amusa [12] also showed that treatments of seed with sulphuric acid and hot water soaking are some factors that can significantly influence germination of *T. indica*. Hot water soaking gave higher percentage germination than ordinary water. Seed germination increased with increasing acid concentration and treatment time contrary to the results of this study where soaking of maize seeds in 30% sulphuric acid for 30 min gave the highest germination percentage while the longest time of soaking (50 min) gave the least germination percentage. Thus, it could be said that different plant seeds react to acid treatment differently.

Table 6-8 revealed the height readings of different treatment sources and treatment durations and how significantly it affected the height of *Zea mays*. The total height ranged from 251.04 to 277.88 cm in seeds soaked in 30% H_2S0_4 for 10-50 min, with 40 min treatment duration having the highest total height of 277.88 cm. The maximum height ranged from 217.68 to 244.05 cm observed in *Zea mays* seed treated with vernalization for different time durations. 24 h vernalization recorded the highest height. In seeds of *Zea mays* soaked in distilled water, plant height ranged from 213.88 to 238.14 cm at different time intervals, with 36 hours hydrotreatment having the highest height; while the maximum total height of 290.56 cm was recorded in seeds control replicate, thus the result obtained in the control experiment gave a different range from what was obtained in the treated seeds and of course a better height performance.

Mean stem girth from different treatment of seeds at various durations were observed and recorded. The maximum girth confidence interval for *Zea mays* seeds soaked in 30% H_2S0_4 for 20 minutes was between 5.65 to 5.79 cm. The maximum girth confidence interval for *Zea mays* seeds treated with vernalization for 24 hours ranged between 3.93 to 4.17. More so, the maximum girth confidence interval for *Zea mays* seeds soaked in distilled water for 36 hours was between 4.11 to 4.33 cm, while the maximum girth confidence interval for the control sample in *Zea mays* ranged between 2.28 to 6.15 cm. Studies have shown that a superior response is often obtained from soaking rice (*Oryza sativa* L.) or corn (*Zea mays* L.) for 18 hours. Treated seeds have been reported to give rise to crops, which matured earlier, and gave higher yields.

Earlier works showed that the success of seed treatment is influenced by the complex interaction of factors including plant species, water potentiality of the treatment agent, duration of treatment, temperature, seed vigor and dehydration, and storage conditions of the treated seed [9]. Although, previous studies indicate that some benefits are associated with pre-sowing treatments for seed vigor enhancement, but there is dearth of information about the germination performance of treated seeds of maize inbred lines. So it was imperative to develop suitable techniques in order to improve maize seed germination capacity. The present study was, therefore, carried out with objective to evaluate the effects of different treatment treatments on seed germination behavior of maize inbred lines under laboratory conditions to find out the most promising technique.

The farmers treated seed in (the past for gap-filling or in dry years). Water or any other reagent is used for the soaking of the seed to split or soften the hard seed coat for speeding up and synchronizing the germination and growth process in okra. The treatment practice is gaining popularity after the application of participatory approach in Africa, Nepal, India, Bangladesh and Pakistan [11]. Treatment of corn seed has spread to Thailand, Kenya, Uganda, Ethiopia, India and Tanzania. Corn grown from treated seeds generally emerges earlier and in greater numbers, grows more vigorously, flowers and matures earlier and often yields better than those from non-treated seeds. Farmers in India reported that treated crops emerged 2-3 days earlier than nonprime ones [14].

CONCLUSION

In conclusion, the present study was carried out with the objective to evaluate the effects of different treatments on seed germination and growth of *Z. mays* under laboratory conditions to find out the most promising technique. The study showed that all treatments which includes soaking in sulphuric acid, vernalization and soaking in water at different time intervals gave significantly positive outcomes as germination of seeds and morphometric features were significantly improved, but based on availability of these treatments, hydro-treatment most recommended by this study for farmers to use. The cultivation of *Zea mays* should be encourage because they serve as necessary vegetables to man. Farmers are informed of the greater possible advantages in seed treatment before sowing, viz; the high input of germination, low susceptibility to insects and diseases outbreak, high plant growth and development and good agricultural yields.

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