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ENHANCEMENT THE SEEDLING QUALITY OF OKRA THROUGH PRIMING WITH H_2O_2

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ABSTRACT - The experiment was conducted to evaluate the physiological fluctuations in the seeds of okra seeds primed with the aqueous solutions of H_2O_2 and to find the suitable strength(s) of H_2O_2 as the priming material for their highest seedling quality. The experiment had eight treatments: T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2: T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%). The seeds were soaked for six hours in those seven media (T_2 toT_8). The seeds were dibbled in wooden seed flats filled-in with coarse sand. The experiment was laid-out in the RCBD with three replications. Data collected for the 13 traits were: % germination, % abnormal seedlings, shoot length, root length, seedling length, shoot dry matter, root dry matter, seedling dry matter, number of secondary roots (>1cm) per seedling, number of true leaves per seedling, relative growth rate, seedling vigor index, and root: shoot ratio (dry weight basis). Except the first two traits, the rest 11 were collected at three stages: 10, 20 and 30 days after dibbling (DAD). It was lucid that H_2O_2 was significantly ($P \leq 0.05\%$) effective to improve most of the traits noted. But 1% concentration was utmost helpful for both okra and others were toxic and hindered the maximum parameters for all the three species. Nevertheless, further studies with different varieties of those three vegetables species with variable doses of H_2O_2, priming time and temperature could be explored before drawing valid conclusions.

Key words: Enhancement, Seedling Quality,Okra, Priming, H_2O_2

I. INTRODUCTION

Okra (Abelmoschusesculentus L.) of family Malvaceae is an important vegetable crop grown in many tropical, subtropical and warmer temperate areas [1]. Okra is an erect, coarse, robust annual herb in which flowers are borne singly in the leaf axile on peduncles. The plant has malvaceous floral organization with 8-10 very narrow, hairy, bracteoles forming an epicalyx. The leaves are, leathery or rough, large, alternate, cordate divided into 3-7 lobes with notched or toothed margins. Flower borne singly in the leaf axils on peduncles 2 to 5 cm long with malvaceous floral organisation The fruits are light green or sometimes red in colour, long (10-30 cm), beaked, ridged;

more or less oblong hairy capsules that dehiscing longitudinally [2-6].

Seed germination is one of the vital stages in the life cycle of seeded plants. Germination is a very complex process starting with the imbibition of H_2O and involves events related with the transition of a dry quiescent and / or dormant seed to the metabolically active state [7-8]. The emergence of the embryonic axis through structures surrounding the embryo is the final stage of germination [9]. In this link, seed priming is used as a means to enhance seed performance, notably in terms to the rate and the uniformity of germination [10]. Seed priming is known as the pre-sowing approach to govern seed germination and seedling development by modulating pre-germination metabolic activities prior to emergence of the radicle and usually enhances germination rate and plant growth [11]. Various physiological and bio-chemical changes happen in seeds during priming as a result of osmotic conditioning. A wide range of pre-sowing hydration techniques is used to enhance seed germination responses. These include equilibrium under conditions of high humidity [12], soaking in plain H_2O [13] or osmotic solutions [14] and having equilibrium with a matric potential controlling surface [15]. Hydro-priming, osmo-priming (with mannitol or PEG 6000) and halo-priming (with KCl, KNO_3 or calcium salts) are effective for seedling establishment under harsh conditions [16]. The priming enhances rapid and uniform emergence, high vigor and better yield, which has practical utilities, preferably under water stress conditions [17].

Priming of seeds with H_2O_2 leads to break primary dormancy [18]; secondary dormancy provoked by salinity [19] and germination inhibitors [20]. It acts as a stress signal in plants and hence exogenous uses of H_2O_2 in the right dose ameliorates seed germination, reduces time to germinate and seedling growth in many crops [21]. So, it has special roles, especially in invigorating seeds with low vigor including long-term stored seeds in gene banks. So, instead of H_2O, seed priming with aqueous solution of H_2O_2 with the appropriate dose could be an applicable technology [22]. But, information in this connection is lacking with the seeds of the okra. The present study was conducted to evaluate the physiological changes of the seedlings of okra primed with the aqueous solution of eight different concentrations of H_2O_2 and find the best one.

II. MATERIALS AND METHODS

The present research work was conducted at the roof top of Sunway Dormitory near the Bus Terminal, Dinajpur, Bangladesh.The seeds of okra collected from the Popular Seed Limited, Bangladesh: okra cv. Arka, was used as the testing seed materials.

2.1 Experimental treatments

This single factor experiment was designed with eight treatments viz. T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2: T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%). This single factor experiment was set in the Randomized Complete Block Design (RCBD) with three replications.

2.2 Seed flats and their arrangements

The seed were debbled in wooden seed flats. The size of each flat was 50×50×15cm. Firstly; the flats were set on the roof top. Then blue polyethylene sheet was spread at the bottom of the flats to protect washing away of sand from the seed flats. Then flats were filled-in with coarse sand.

2.3 Preparation of the required H_2O_2 solutions

The required solutions were prepared by diluting the required amounts of the H_2O_2 (30% strength, Plate 1) with H_2O to get these six concentrations: 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0%.

Plate 1. The container of the H_2O_2(30%)used in the study

2.4 Priming process

At first, only H_2O and those six solutions were taken in plastic glasses separately. The glasses were marked about the treatments and replications with a permanent glass marker. Then the 200 seeds for each replication were taken in plastic glasses to soak in the desired solutions for six hours in the Laboratory of Horticulture (Plate 2).

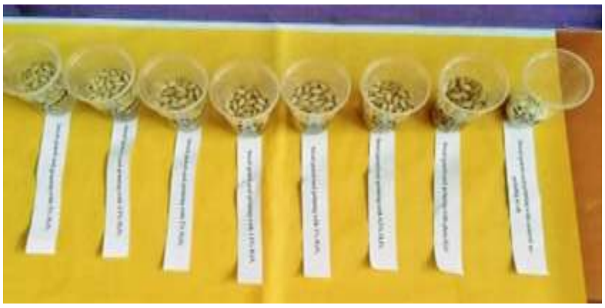

Plate 2. Priming process with H_2O_2

2.5 Dibbling the seeds and caring the seedlings
The unprimed and the primed seeds were then dibbling immediately in the seed flats (Plate 3) at the depth of 2cm in lines on the 10th March, 2019 at the distance of 5cm between rows and seeds too. After sowing, the seeds were covered with hyaline polyethylene sheet and concrete poles (at one foot high) to protect the seeds and seedlings from heavy rainfall. Light watering with a watering cane was done as needed. Hand weeding was also done as per need.

Plate 3. Growingthe seedlings in the seed flats

2.6 Data collection
The data were collected for % germination and % abnormal seedlings at 10 days of dibbling and shoot length, root length, seedling length, shoot dry matter, root dry matter, seedling dry matter, number of secondary roots (>1cm) per seedling, number of true leaves per seedling, relative growth rate, seedling vigor index, and root: shoot ratio (dry weight basis) at 10, 20 and 30 DAD.
Germination (%) and normal seedling (%) were observed and counted as per the ISTA (2010) rules daily up to 10 DAD. For dry matter the normal seedlings were cut and divided into roots and shoots with a razor blade from each treatment and replication wise. Then those were first sundried separately for two days. After that, those were dried at 80°C for 48 hours in an electric oven (Memmrert, ULP 400). Then the dry weights of shoots were recorded up to four decimal places with an electric digital balance (Ohaus, pioneer pro PA214). Finally, the dry weights were expressed in gram per 100-seedling basis. Those processes were repeated with the normal seedlings only obtained from the 10, 20 and 30 DAD. Relative growth rate (RGR)was calculated as per Williams (1946) formula and Seedling vigor index (SVI) was calculated as per Orchard (1977) and Baki and Anderson (1973) viz. SVI = Mean seedling (root + shoot) length (MSL) in cm ×% germination (PG)

2.7 Statistical analyses
The analyses of variances (ANOVA) were done and the means were separated using Duncan's Multiple Range Test (DMRT). The MSTAT-C Statistical Package program was used for it.

III. RESULTS AND DISCUSSION

3.1 Germination %
The priming treatments had a significant effect($P\leq0.05$) on the % germination of okra seeds (Fig. 1).The highest (88.00) and the lowest (79.33%) rates of germination were related to primed seeds with 1% (T_4) and 3% (T_8) H_2O_2 solutions, respectively. The results clearly show that more germination advantage of okra seeds were achieved by priming with H_2O_2as priming changed the germination mechanism due to improved breaking primary and secondary dormancy and also prevents suffocation. In that case, the highest germination % occurred when the seeds were primed with the 1% H_2O_2 solution (T_4). However, the higher doses (>1%) of H_2O_2 probably caused harmful effects on the germination and so, the germination % became low, even than the unprimed and the hydro-primed seeds. The H_2O_2 levels >2% resulted in severe injury to germinating seeds of bitter gourd [23] (John and Duval, 2000). [24] Nandi et al. (2017) found better germination in chilli seeds at the 2% concentration of H_2O_2. [25] Mustafa (2017) studied cucumber, swamp cabbage, radish and Indian spinach seeds and had better germination at 1% H_2O_2. While working with bitter gourd and bottle gourd, [26] Lima (2017) found better germination at 1.5% H_2O_2. But Iqbal et al. (2001) [27] found higher germination in okra seeds at 2% concentration with H_2O_2. Furthermore, Kaya et al. (2006) [28] reported that priming increased % germination of sunflower seeds under drought stress. Barba-Espinet al. (2010) [29] claimed that H_2O_2 increased the germination % of pea seedlings in a concentration-dependent manner.

3.2 Percent abnormal seedlings
There was significant difference ($P\leq0.05$) for the effects of H_2O_2 concentrations among the treatments in respect of % abnormal seedlings (Fig. 2). The maximum % abnormal seedlings (5.66) were recorded in T_8 while the lowest (2.00%) was counted in T_4. The results show that the incidences of abnormal seedlings increased significantly

with the rise in H_2O_2 concentrations. In bitter gourd and bottle gourd seeds, [26] Lima (2017) noted the Minimum% abnormal seedlings with 1.5% while the maximum at the 3% H_2O_2. Parallely, [25] Mustafa (2017) recorded the minimum % abnormal seedlings with swamp cabbage, radish and Indian spinach seeds at 1% but the maximum abnormal seedlings with 3% H_2O_2. In addition, Kaya et al. (2006) [28] reported that priming reduced the number of abnormal seedlings of sunflower under drought stress.

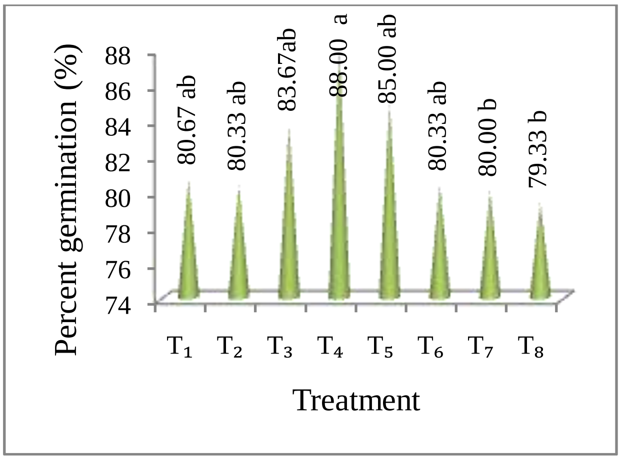

Fig. 1. Effect of priming seedwith H_2O_2 on the % germination of okra

T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

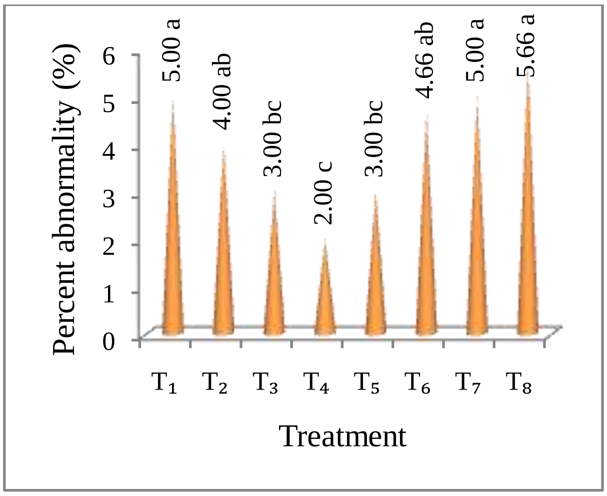

Fig. 2. Effect of priming seeds with H_2O_2 on the %abnormal seedlings of okra

T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

3.3 Shoot, root and seedling length (cm)

The shoot, root and seedling length were significantly different ($P \leq 0.05$) for the effects of H_2O_2 concentrations at all the three DADs (Table 1). At the 10, 20 and 30 DAD, the longest shoot was observed in T_4 (5.99, 7.38 and 9.15 cm, respectively) while the shortest one was in T_8 (5.37, 6.52 and 7.98 cm, respectively). The highest root length (4.91, 13.96 and 16.64 cm) was obtained from T_4 while the lowest (3.53, 11.28 and 15.01cm) was recorded from T_8 at the 10, 20 and 30 DAD, respectively. At the 10, 20 and 30 DAD, the tallest seedling (10.89, 21.39 and 25.80 cm) was measured in T_4 while the shortest one (8.91, 17.81 and 22.99 cm) was recorded in T_8. H_2O_2 influenced the vegetative growth of the seedlings and the ultimate results were the longest seedlings compared to the control one. During the seedling growth, the highest shoot length was found when was primed with 1% H_2O_2 and the lowest was when 3% H_2O_2 solution was used. In bitter gourd and bottle gourd seeds, [26] Lima (2017) measured the minimum shoot and seedling length with 1.5% whiles the maximum at the 3% H_2O_2. Mostafa (2017) also noted the minimum shoot length with swamp cabbage, radish and Indian spinach seeds at 1% but the maximum shoot and seedling length with 3% H_2O_2. But 1.0% was very helpful for country bean and yard long bean while 1.5% for bottle gourd and bitter gourd seeds. Above 1.5%, others were toxic [26] (Lima, 2017). While working with seeds of two varieties of okra, Iqbal et al. (2001) [27] also achieved nearly similar results with the concentration i.e. 2% H_2O_2. The H_2O_2 treatment, which increased shoot lengths, may be useful in crop production as rapid growth of seedling is vital for the better establishment of seedlings [29] (Ogiwara and Terashima, 2001). Again, the higher doses (>1%) of H_2O_2 probably caused poison effects on shoot length and so, the shoot length became low, even that the unprimed and the hydro-primed seeds. However, the applications of H_2O_2 at doses of 1.8mM each eight days broccoli seedlings, increased the stem length and fresh weight, whereas the dose 1.4mM increased the biomass of broccoli seedlings [30] (Leon-Vargas et al., 2016). The influences of seed priming in improving the root length had also been well documented in ground nut by [31] Rahman et al. (1997). [24] Nandi et al. (2017) noted the maximum root length in seedlings of chilli raised from the seeds treated with the 1.0% H_2O_2.

Table 1. Effect of priming seedwith H_2O_2 onshoot, root and seedling length in okra

Treatments	Shoot length (cm)			Root length (cm)			Seedling length (cm)		
	10 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD
T_1	5.44b	6.79bc	8.59b	4.35ab	12.14bc	15.43bc	9.76bc	18.93c	24.03b-d
T_2	5.52b	7.11ab	8.44bc	3.92bc	12.01bc	15.03c	9.44cd	19.12c	23.48b-d
T_3	5.48b	6.92bc	8.48bc	3.90bc	12.39b	15.76a-c	9.38cd	19.34c	24.24bc
T_4	5.99a	7.38a	9.15 a	4.91a	13.96a	16.64a	10.89a	21.39a	25.80a
T_5	5.71ab	7.12ab	8.08cd	3.79bc	13.40a	15.18c	9.50c	20.48b	23.26cd
T_6	5.47b	6.86bc	8.36b-d	4.63a	11.84bc	16.21ab	10.11b	18.71c	24.58b
T_7	5.50b	6.88bc	8.39b-d	3.78bc	12.15bc	14.97c	9.28cd	19.03c	23.36cd
T_8	5.37b	6.53c	7.98d	3.53c	11.28c	15.01c	8.91d	17.81d	22.99d
LSD $_{(0.05)}$	0.313	0.379	0.395	0.580	0.886	0.901	0.5015	0.7968	1.074
CV %	3.22	3.10	2.68	8.09	4.08	3.31	2.96	2.35	2.56

The figures with different letters differ among themselves at the 5% level of probability.

T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

3.4 Shoot, root and seedling dry matter

There was significant variation ($P \leq 0.05$) in shoot, root and seedling dry matter (g per 100-seedling basis) accumulation among the treatments at all the three DADs (Table 2). At 10, 20 and 30 DAD, the shoot gathered the utmost amount of dry matter (6.93, 9.16 and 19.64 g, respectively) in T_4 although the minimum (5.74, 6.75 and 15.99 g, respectively) was observed in T_8. The highest dry matter in roots was deposited in T_4 (1.14, 1.64 and 4.46 g) and the minimum dry matter of roots was weighed in T_8 (0.64, 1.15 and 3.63 g) at 10, 20 and 30 DAD, respectively. At the 10, 20 and 30 DAD, the highest dry matter formation in seedlings was obtained at T_4 (8.08, 10.82 and 24.11 g, respectively) while the least was in T_8 (6.36, 7.90 and 19.62 g, respectively). While dealing with the seeds of bitter gourd and bottle gourd, [26] Lima (2017) noted the highest shoot, root and seedling dry matter at 1.5% H_2O_2. [25] Mustafa (2017) recorded the maximum dry matter in shoot root and seedlings of swamp cabbage, radish and Indian spinach primed with 1% H_2O_2 and above 1.5%, others were toxic. Soaking seeds in various concentrations of H_2O_2 resulted in enhanced stomatal density, and increased length and histological components of leaves. Those changes were positive since plants of H_2O_2-soaked seeds had higher dry weight [32] (Jafariyan and Zarea, 2016). Again, the higher doses (> 1%) of H_2O_2 probably caused toxic effects on the seedling dry matter and so, it became less, even than those of the unprimed and the hydro-primed seeds. Furthermore, Kaya et al. (2006) [28] experienced that priming increased seedling dry matter of sunflower under drought stress condition.

Table 2. Effect of priming seedwith H_2O_2 onshoot, root and seedling dry matter of okra

Treatments	Shoot dry matter			Root dry matter			Seedling dry matter		
	10 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD
T_1	6.01ab	8.22ab	18.20ab	0.79bc	1.46ab	4.13ab	6.80bc	9.68ab	22.11b
T_2	6.88a	8.63ab	18.50ab	0.76bc	1.30bc	3.79ab	7.65ab	9.933ab	22.35b
T_3	6.50ab	8.68ab	18.55ab	0.86b	1.37a-c	3.97ab	7.37abc	10.15ab	22.52b
T_4	6.93a	9.16a	19.64a	1.14a	1.64a	4.46a	8.08a	10.82a	24.11a
T_5	6.450ab	7.66bc	17.55bc	0.84bc	1.29bc	3.83ab	7.29a-c	9.29b	21.37bc
T_6	6.57ab	7.89b	16.28cd	0.86b	1.31bc	3.94ab	7.44a-c	9.55b	20.2cd
T_7	6.53ab	7.80bc	16.64cd	0.78bc	1.34bc	3.69b	7.31a-c	9.15b	20.33cd
T_8	5.74b	6.75c	15.99d	0.64c	1.15c	3.63b	6.36c	7.90c	19.62d
LSD $_{(0.05)}$	1.015	1.042	1.368	0.191	0.271	0.626	1.001	1.140	1.436
CV %	8.97	7.35	4.42	13.23	11.28	9.09	7.85	6.81	3.80

The figures with different letters differ among themselves at the 5% level of probability.
T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

3.5 Number of secondary roots and true leaves

The number of secondary roots and true leaves varied appreciably ($P \leq 0.05$) due to the effects of H_2O_2 concentrations at all the three DADs (Table 3). At the 10, 20 and 30 DAD, the highest number of secondary roots was recorded in T_4 (8.59, 14.78 and 20.30) but the lowest number was counted in T_8 (7.02, 11.66 and 17.86). At the 10, 20 and 30 DAD, the maximum number of true leaves was recorded from T_4 (0.91, 1.80 and 3.23) while the minimum was found in T_8 (0.80, 1.36 and 2.93). Again, the higher doses (over 1%) of H_2O_2 probably caused harmful effects for the number of secondary roots and true leaves and so, those were fewer in number, even than the unprimed and the hydro-primed seeds. However, when the concentrations of H_2O_2 came up to 5mM, it played an opposite role to inhibit the growth of adventitious roots and seriously damaged those [33] (Deng et al., 2012). Similar types of result were also reported by [26] Lima (2017) in bitter gourd and bottle gourd where the highest number of secondary roots and true leaves was at 1.5% concentration of H_2O_2. Again, [25] Mustafa (2017) recorded the mumber of secondary roots (>1cm) and true leaves per seedling of cucumber, swampcabbage, radish and Indian spinach seeds primed with 1% H_2O_2. But the excessive accumulation of H_2O_2 leads to cellular oxidative damage and even programmed death [34-35] (Levine et al., 1994 and Prasad et al., 1994) and thus becomes poisonous for seedlings.

Table 3. Effect of priming seedwith H_2O_2 on number of secondary root and true leaves of okra

Treatments	Number of secondary roots			Number of true leaves		
	10 days	20 days	30 days	10 days	20 days	30 days
T_1	7.40ab	12.83bc	19.09ab	0.86a-c	1.56bc	3.057a
T_2	6.56b	14.57a	18.08b	0.90ab	1.62ab	3.167a
T_3	7.51ab	12.57bc	18.86ab	0.88a-c	1.60ab	3.143a
T_4	8.59a	14.78a	20.30a	0.91a	1.80a	3.233a
T_5	7.15ab	13.47ab	18.07b	0.83a-c	1.63ab	3.077a
T_6	7.63ab	12.06bc	18.52b	0.81bc	1.65ab	3.087a
T_7	8.43a	13.16b	18.61b	0.88a-c	1.63ab	2.947a
T_8	7.02ab	11.66c	17.86b	0.80c	1.36c	2.930a
$LSD_{(0.05)}$	1.478	1.310	1.410	0.078	0.207	0.282
CV %	11.19	5.70	4.31	5.12	7.37	5.23

The figures with different letters differ among themselves at the 5% level of probability.
T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

3.6 Seedling vigor index

The seedling vigor index differed significantly ($P \leq 0.05$) due to the different concentrations of H_2O_2 at all the three DADs (Table 4). At the 10, 20 and 30 DAD, the highest seedling vigor index was recorded from T_4 (958.3, 1882 and 2270, respectively) while the least value was recorded from T_8 (706.8, 1882 and 1824, respectively). [25] Mustafa (2017) also recorded the maximum seedling vigor index of swamp cabbage, radish and Indian spinach seeds primed with 1%, H_2O_2. [26] Lima (2017) and [24] Nandi et al. (2017) found similar findings on seedling vigor index.

Table 4. Effect of seed priming with H_2O_2 on Seedling vigor index,**relative growth rate and root shoot ratio of okra**

Treatments	Seedling vigor index			Relative growth rate		Root shoot ratio		
	10 DAD	20 DAD	30 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD
T_1	787.8b-d	1527cd	1938b-d	0.033a	0.076a	0.130a	0.173a	0.220a
T_2	758.8cd	1556cd	1886c-e	0.020a	0.076a	0.110a	0.143a	0.200a
T_3	814.3b	1585c	2028b	0.016a	0.076a	0.133a	0.153a	0.210a
T_4	958.3a	1882a	2270a	0.026a	0.076a	0.163a	0.180a	0.223a
T_5	807.8bc	1785b	1977bc	0.016a	0.076a	0.126a	0.186a	0.213a
T_6	812.0b	1503d	1974bc	0.020a	0.070a	0.126a	0.176a	0.236a
T_7	742.5de	1523cd	1869de	0.020a	0.073a	0.120a	0.166a	0.216a
T_8	706.8e	1413e	1824e	0.016a	0.070a	0.106a	0.176a	0.220a
$LSD_{(0.05)}$	49.02	69.88	87.85	0.0553	0.0553	0.0553	0.055	0.055

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CV %	3.51	2.50	2.55	40.43	14.74	17.21	13.15	10.98

The figures with different letters differ among themselves at the 5% level of probability.

3.7 Relative growth rate (RGR)

There was no significant variation in the relative growth rate among the treatments at 20 and 30 DADs (Table 4). numerically, the maximum relative growth rate was in T_1 (0.033 and 0.076), the minimum relative growth rate was found in T_8 (0.016 and 0.070) at the 20 and 30 DAD. While working with, [25] Mustafa (2017) found the highest relative growth rate at 3% (0.22) in cucumber and Indian spinach seeds. [26]Lima (2017) found relative growth rate in control/no priming (0.11) in bitter gourd seed and bottle gourd seeds.

3.8 Root shoot ratio

There was statistically non-significant variation in root shoot ratio (dry weight basis) among the different treatments at 10, 20 and 30 DAD (Table 4). [26] Lima (2017) and [25] Mustafa (2017) found the maximum root shoot ratio treated with 1% H_2O_2.

IV. CONCLUSIONS

So, from the results of the experiment, it can be concluded that H_2O_2 had optimistic effects on the seedling qualities. Again, among the six concentrations of the H_2O_2, 1%was the most effective one for okra seeds. Above those concentrations, others were somewhat toxic as those hindered a lot of the parameters evaluated.

V. REFERENCES

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T_1 (control/no priming), T_2 (hydro-priming in plain H_2O) and other six aquatic solutions of H_2O_2, T_3 (0.5%), T_4 (1.0%), T_5 (1.5%), T_6 (2.0%), T_7 (2.5%) and T_8 (3.0%)

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