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RESEARCH ARTICLE

ENHANCEMENT OF SWEET GOURD SEEDLING QUALITIES PRIMING WITH H_2O_2

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Abstract

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A study with three independent experiments for the seeds of three vegetable species was set at the roof top of Sunway Dormitory near the Bus Terminal, Dinajpur, Bangladesh, during March to May, 2019. The aims were to evaluate the physiological fluctuations in the seeds of sweet gourd cv. Monitaraprimed with the aqueous solutions of H_2O_2 and to find the suitable concentration. Each 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 experiments were laid-out in the Randomized Complete Block Design with three replications. Data collected for the 13 traits viz. % 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 stagesviz.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. Treatment T_4 (1% concentration) was utmost helpful for sweet gourd and >1.5%, 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.

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Introduction:-

Vegetables are not equally produced throughout the year in the country. Of the total production, less than 25% is produced during Kharif season and more than 75% is in the Rabi season (Anon. 1993). Leaves and even flowers of sweet gourd could be used as vegetables which are rich in various nutrients (Gopalan*et al.* 1982). The main nutrients are lutein and both alpha and beta carotene, the later of which generates vitamin A in the body (Tecson, 2001). Pumpkin is a vegetable that fulfill the needs of healthy nourishment (Kadam*et al.* 2014). Its seeds are admirable

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cradle of protein and furthermore having the pharmacological properties such as antifungal, anti-diabetic and anti-inflammation characteristics (Nkosi*et al.* 2006). The seed extracts have been used as an antidiabetic, antitumor, antibacterial, anticancer and antioxidant (Cl *et al.*2006).

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 (Kranner*et al*., 2011, and Schopfer*et al.*, 2001). The emergence of the embryonic axis through structures surrounding the embryo is the final stage of germination (Weitbrecht*et al*., 2011). 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 (Taylor and Harman, 1998). 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 (Bradford, 1986, and Taylor and Harman, 1998).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 (Finnerty*et al*., 1992), soaking in plain H_2O (Coolbear and McGill, 1990) or osmotic solutions (Knypl and Khan, 1981) and having equilibrium with a matric potential controlling surface (Hardegree and Emmerich, 1992). 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 (Toselli and Casenav, 2003). The priming enhances rapid and uniform emergence, high vigor and better yield, which has practical utilities, preferably under water stress conditions (Black *et al.*, 2006).

H_2O_2 is a reactive molecule playing crucial roles in plants, especially under unfavorable germination conditions, developmental processes and in resisting stresses in reactive oxygen species/ROS (El-Maarouf-Bouteau and Bailly, 2008). H_2O_2 acts as a signaling molecule in the beginning of seed germination involving specific changes at the proteomic, transcriptomic and hormonal levels (Afghani and Taheri, 2012, and Demir*et al*., 2012). Priming of seeds with H_2O_2 leads to break primary dormancy (Jann and Amen, 1997); secondary dormancy provoked by salinity (Jia*et al*., 2002) and germination inhibitors (Ogawa and Masaki, 2001). 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 (Patade*et al*., 2012). 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 (Copeland and Mcdonald, 1985). The objective of the study was to evaluate the physiological changes of the seedlings of sweet gourd primed with of $H_2O_2$and find the best concentration.

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 sweet gourdcv. Monitara used as the testing seed materials and collected from the Popular Seed Limited, Bangladesh.

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.

Seed flats and their arrangements

The seed were debbled in wooden seed flats (50 cm ×50 cm ×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.

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.

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.

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.

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)

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.

Results And Discussion:-

Germination %

There was significant variation ($P \leq 0.05$) in percentage of germination among the treatments (Fig. 1).The maximum germination was recorded in T_4 (90.00) while the minimum was in T_8 (81.33%). Priming of seeds with H_2O_2 changes the germination mechanism due to improved breaking primary and secondary dormancies and prevents suffocation. In this study, the highest % germination (93.67) was found in seeds primed with 1% H_2O_2. Similar results were also obtained by Nandi *et al.* (2017) in chili seeds found better germination at 2% concentration of H_2O_2.That variation could be due to the uses of different seed species. In addition, the higher doses (>1%) of H_2O_2 probably caused deleterious effects on the germination process and so, it became poor, even than the unprimed and the hydro-primed seeds. The H_2O_2 levels >2% resulted in severe injury to germinating seeds (John and Duval, 2000. Mustafa (2017) studied cucumber, swampcabbage, radish and Indian spinach seeds and had better germination at 1% H_2O_2. While working with bitter gourd and bottle gourd, Lima (2017) found better germination at 1.5% H_2O_2. But Iqbal *et al.* (2001) found higher germination in sweet gourd seeds at 2% concentration with H_2O_2.Furthermore, Kaya *et al*. (2006) reported that priming increased % germination of sunflower seeds under drought stress.

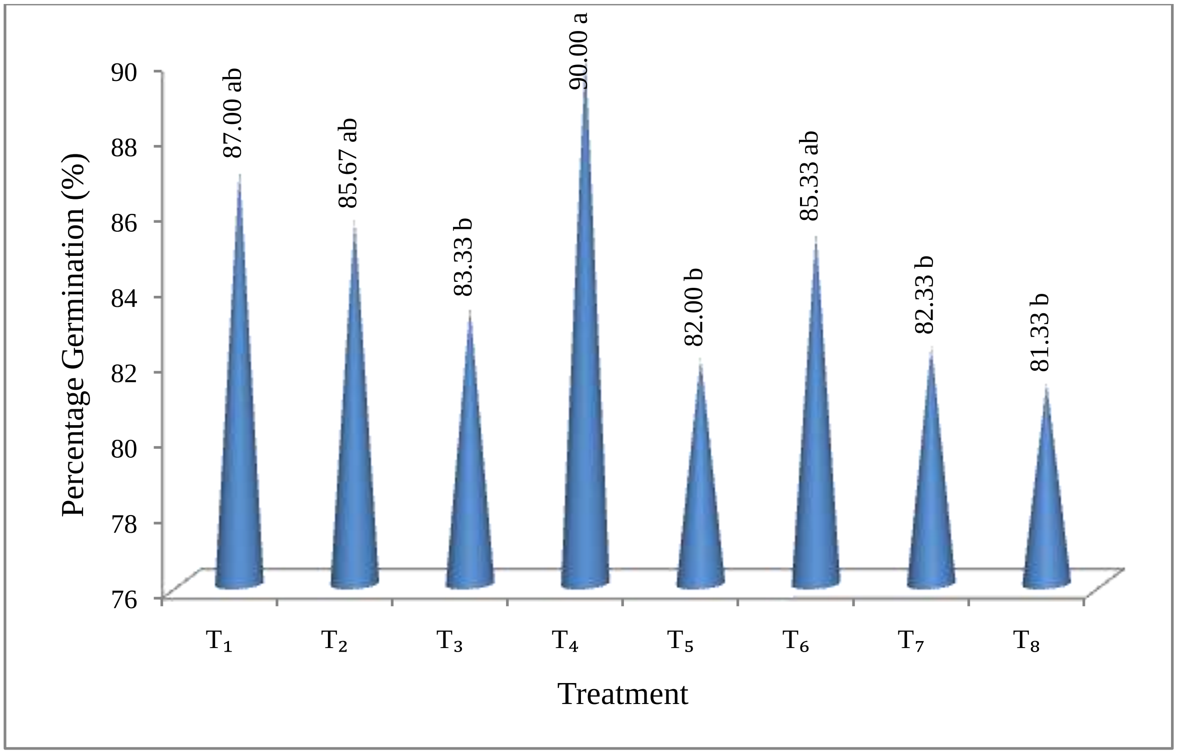

Fig.1:- Effect of seed priming with H_2O_2 on the % germination of sweet gourd.

Abnormal seedlings (%)

There were significant differences (P≤0.05) in % abnormal seedlings among treatments (Fig. 2). The highest % abnormal seedlings were documented in T_8 (5.66) while the lowest was noted in T_4 (2.00). The results showed that the incidence of abnormal seedling increased with increasing of H_2O_2 concentrations which might be due to the harmful effects. Mustafa (2017) andLima (2017) noted the minimum% abnormal seedlings with 1.5% while the maximum at the 3% H_2O_2. Kaya *et al*. (2006) reported that priming reduced the number of abnormal seedlings of sunflower under drought stress.

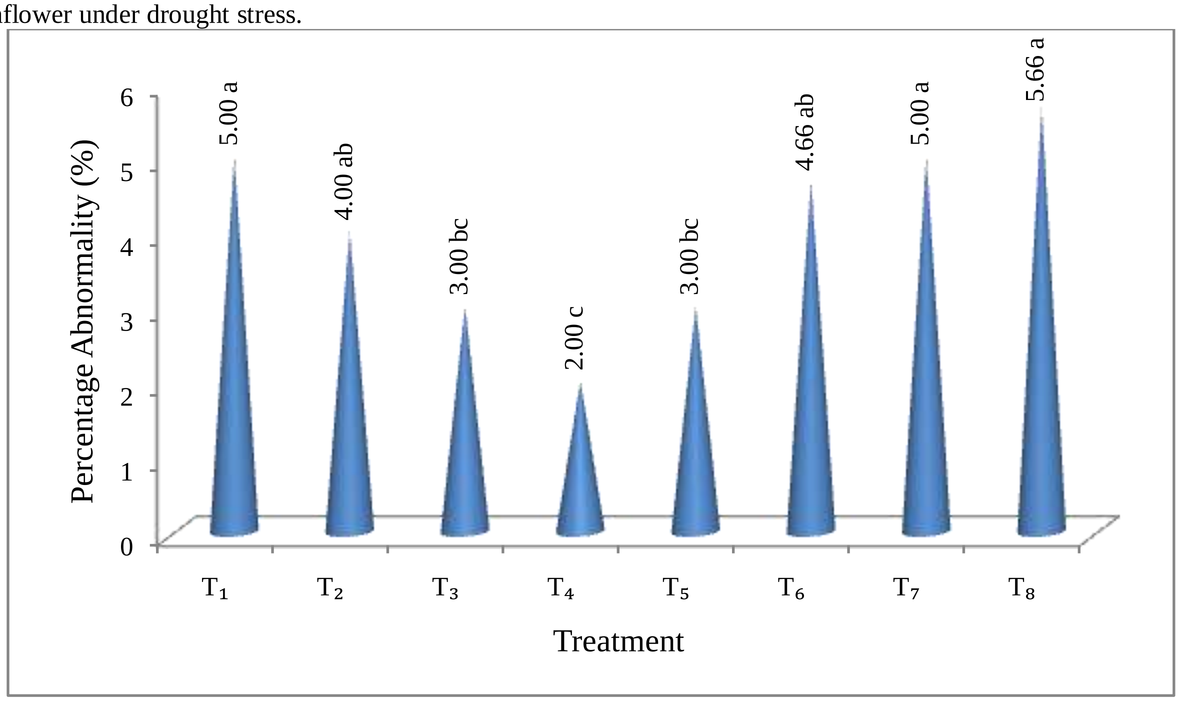

Fig. 2:- Effect of seed priming with H_2O_2 on the %abnormal seedlings of sweet gourd.

Shoot, root and seedling length

The results show that the shoot length varied significantly among the treatments at all the three DADs(Table 1). In case of the 10, 20 and 30DAD, the longest shoot was found in T_4 (6.68, 8.94 and 9.73 cm) but the shortest one was observed in T_8 (5.53, 9.73 and 8.62cm). The highest root length 10, 20 and 30 DAD and was found in T_4 (5.34, 13.46 and 20.02 cm) while the lowest was observed in T_8 (4.02, 11.46 and 20.02 cm).At the 10, 20 and 30 DAD, the tallest seedling was found in T_4 (12.03, 22.40 and 28.75 cm) but the least was observed T_8 (9.55, 15.25 and 24.54 cm). H_2O_2 influenced the vegetative growth of seedlings and the ultimate result was the longest seedlings compared to control. During the period of seedling growth, the highest shoot length was found when seeds were primed with 1% H_2O_2 and the least was found when 3% H_2O_2 was used. The H_2O_2 treatment can increase shoot length which may be useful for direct seeding as rapid growth of seedling is vital for the better establishment of seedlings in direct seeding (Ogiwara and Terashima, 2001). 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 (León-Vargas *et al*., 2016). In bitter gourd and bottle gourd seeds, Lima (2017) measured the minimumshoot, root and seedling length with 1.5% whiles the maximum at the 3% H_2O_2. Mustafa (2017) also noted the minimum shoot, root and shoot length with swampcabbage, radish and Indian spinach seeds at 1% but the maximum with 3% H_2O_2.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 sweet gourd.

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	6.38ab	8.77ab	9.08bc	5.07ab	11.76c	17.87a	11.46ab	20.54a	26.96ab
T_2	5.95bc	8.13cd	9.27ab	4.37cd	12.60b	19.52a	10.33c	20.73a	28.79a
T_3	6.26ab	8.33bc	9.39ab	5.03ab	12.56b	19.05a	11.30ab	20.89a	28.44a
T_4	6.68a	8.94a	9.73a	5.34a	13.46a	20.02a	12.03a	22.40a	28.75a
T_5	6.08abc	8.00cd	8.97bc	4.79bc	11.62c	17.41a	10.74bc	19.63a	26.38bc
T_6	5.86bc	7.67de	8.99bc	4.47c	12.65b	12.82b	10.34c	20.33a	25.15bc
T_7	6.22ab	7.79de	9.06bc	4.56c	11.70c	16.74ab	10.79bc	19.50a	25.80bc
T_8	5.53c	7.45e	8.62c	4.02d	11.46c	16.03ab	9.555d	15.25b	24.54c
$LSD_{(0.05)}$	0.619	0.476	0.522	0.418	0.771	3.772	0.751	3.705	1.794
CV %	5.78	3.35	3.26	5.07	3.60	12.36	3.97	10.63	3.81

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), T_3 = 0.5% aquatic solutions of H_2O_2, T_4 = 1.0% aquatic solutions of H_2O_2, T_5 = 1.5% aquatic solutions of H_2O_2, T_6 = 2.0% aquatic solutions of H_2O_2, T_7 = 2.5% aquatic solutions of H_2O_2 and T_8 = 3.0% aquatic solutions of H_2O_2

Shoot, root and seedling dry matter

There was statistically significant variation (P≤0.05) in shoot, root and seedling dry matter accumulation among the treatments at all the three DADs (Table 2). At the 10, 20 and 30DAD, the maximum dry matter of shoots was observed in T_4 (14.22, 20.97 and 32.07 g) while the minimum was recorded in T_8 (10.79, 17.24 and 25.64g). The highest dry matter of roots at the 10, 20 and 30 DAD, was found in T_4 (2.60, 7.20 and 9.73 g) but the lowest was recorded T_8 (1.70, 3.99 and 6.85g). At 10, 20 and 30 DAD, the topmost dry matter of seedlings was found in T_4 (16.83, 28.17 and 41.80 g) but the lowest was observed in T_8 (12.70, 21.23 and 32.49g). In addition, the higher doses (>1%) of H_2O_2 probably caused harmful effects on the shoot and so, it became poor, even than 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 1.4m increased the biomass of broccoli seedlings (León-Vargas *et al*.,2016). In bitter gourd and bottle gourd seeds, Lima (2017) experienced the maximum shoot, root and seedling dry matter primed with the 1.5% H_2O_2. In contrast, Mustafa (2017) recorded the maximum shoot, root and seedling dry matter with swampcabbage, radish and Indian spinach seeds at 1% but the minimum shoot, root and seedling dry matter with 3% H_2O_2. Above 1.0%, others were toxic and hindered most of the parameters (Mustafa, 2017).Kaya *et al*. (2006) reported that priming increased the soot, root and seedling dry weight of sunflower under drought stress.

Table 2:- Effect of priming seedwith H_2O_2 onshoot, root and seedling dry matter of sweet gourd.

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	12.51b	18.99bc	27.41de	2.06bc	5.42b	7.97b	14.57bc	24.41b	35.38c
T_2	12.07bc	19.06bc	28.11cd	2.04bc	4.84bc	7.59bc	14.12bc	23.90b	35.70c
T_3	11.44cd	18.46cd	30.35b	2.34ab	4.72bc	8.02b	13.78c	23.19bc	38.38b
T_4	14.22a	20.97a	32.07a	2.60a	7.20a	9.73a	16.83a	28.17a	41.80a
T_5	12.58b	19.82ab	29.35bc	2.20b	4.66bc	7.24bc	14.78b	24.49b	35.99c
T_6	12.11bc	18.19cd	27.70de	2.06bc	6.46a	7.19bc	14.18bc	24.65b	34.89c
T_7	12.56b	17.66d	26.62ef	1.84cd	4.26c	8.15b	14.41bc	21.93cd	34.76c
T_8	10.79d	17.24d	25.64f	1.70d	3.99c	6.85c	12.70d	21.23d	32.49d
$LSD_{(0.05)}$	0.861	1.167	1.371	0.298	0.989	0.928	0.823	1.543	2.010
CV %	4.00	3.54	2.76	8.14	10.87	6.76	3.26	3.67	3.17

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), T_3 = 0.5% aquatic solutions of H_2O_2, T_4 = 1.0% aquatic solutions of H_2O_2, T_5 = 1.5% aquatic solutions of H_2O_2, T_6 = 2.0% aquatic solutions of H_2O_2, T_7 = 2.5% aquatic solutions of H_2O_2 and T_8 = 3.0% aquatic solutions of H_2O_2

Number of secondary roots andtrue leaves per seedling

The number of secondary roots and true leaves was statistically significant variation ($P \leq 0.05$) among the treatments at the 10, 20 and the 30DADs(Table 3). At the 10, 20 and 30DAD, the maximum number of secondary roots and true leaves was counted in T_4 (11.05, 14.35 and 21.53) while the minimum was observed in T_8 (6.00, 9.67 and18.01). At the 10, 20 and 30 DAD, the utmost number of true leaves was experienced in T_4 (0.93, 3.14 and 4.36) while the minimum was recorded in T_8 (0.80, 2.50 and 4.36). Similar kindsof result were also reported by 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, Mustafa (2017) recorded the number of secondary roots and true leaves per seedlingof cucumber, swampcabbage, radish and Indian spinach seeds primed with 1% H_2O_2.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 (Deng *et al*.,2012).

Table 3:- Effect of priming seedwith H_2O_2 on number of secondary root and true leaves of sweet gourd.

Treatments	Number of secondary roots			Number of true leaves		
	10 DAD	20 DAD	30 DAD	10 DAD	20 DAD	30 DAD
T_1	6.85def	12.36cd	21.08ab	0.860b	3.13a	4.61b
T_2	7.25cde	13.30b	18.50cd	0.833bc	2.56a	4.50b
T_3	9.33b	10.81e	20.94ab	0.883ab	2.55a	4.55b
T_4	11.05a	14.35a	21.53a	0.933a	3.14a	5.03a
T_5	8.31bc	10.25ef	18.40cd	0.850bc	2.59a	4.66ab
T_6	7.75cd	13.20bc	18.50cd	0.850bc	2.85a	4.61b
T_7	6.21ef	11.85d	19.75bc	0.866b	2.85a	4.63b
T_8	6.00f	9.67f	18.01d	0.800c	2.50a	4.36b
$LSD_{(0.05)}$	1.124	0.889	1.479	0.055	0.638	0.375
CV %	8.18	4.25	4.31	4.11	13.16	4.63

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), T_3 = 0.5% aquatic solutions of H_2O_2, T_4 = 1.0% aquatic solutions of H_2O_2, T_5 = 1.5% aquatic solutions of H_2O_2, T_6 = 2.0% aquatic solutions of H_2O_2, T_7 = 2.5% aquatic solutions of H_2O_2 and T_8 = 3.0% aquatic solutions of H_2O_2

Seedling vigor index (SVI)

There was significant variation ($P \leq 0.05$) in seedling vigor index among the treatments at all the three DADs (Bar diagram.3.11 and Appendix III) judged. At 10, 20 and 30 DAD maximum value was found in T_4 (1083.0, 2016 and 2588) while the minimum value was in T_8 (777.0, 1511 and 1996).Similar types of results were also reported by Nandi *et al.* (2017) in chili seeds. In addition, the higher doses (>1%) of H_2O_2 might cause deleterious effects on the seedlings and so, it became less, even than the unprimed and the hydro-primed seeds. While working with yard long bean seeds, Lima (2017) noted seedling vigor index at 1% H_2O_2.

Table 4:- Effect of seed priming with H_2O_2 on Seedling vigor index,relative growth rate and root shoot ratio of sweet gourd.

Treatments	Seedling vigor index			Relative growth rate		Root shoot ratio		
	10 DAD	20 DAD	30 DAD	10-20 DAD	20-30 DAD	10 DAD	20 DAD	30 DAD
T_1	997.0b	1787b	2346b	0.050a	0.083a	0.156a	0.280b	0.286a
T_2	884.9c	1776b	2466ab	0.046a	0.090a	0.163a	0.250b	0.266a
T_3	941.6bc	1763b	2370b	0.046a	0.096a	0.200a	0.250b	0.260a
T_4	1083.0a	2016a	2588a	0.046a	0.090a	0.176a	0.336a	0.286a
T_5	881.0c	1609c	2163c	0.046a	0.086a	0.170a	0.230b	0.243a
T_6	882.3c	1735b	2146cd	0.053a	0.083a	0.166a	0.350a	0.253a
T_7	888.1c	1605c	2124cd	0.036a	0.086a	0.143a	0.240b	0.300a
T_8	777.0d	1511d	1996d	0.050a	0.090a	0.153a	0.226b	0.263a
$LSD_{(0.05)}$	62.50	53.88	153.2	0.055	0.055	0.055	0.055	0.055
CV %	3.89	1.78	3.85	10.87	5.45	10.04	12.07	7.21

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), T_3 = 0.5% aquatic solutions of H_2O_2, T_4 = 1.0% aquatic solutions of H_2O_2, T_5 = 1.5% aquatic solutions of H_2O_2, T_6 = 2.0% aquatic solutions of H_2O_2, T_7 = 2.5% aquatic solutions of H_2O_2 and T_8 = 3.0% aquatic solutions of H_2O_2

Relative growth rate (RGR)

There was insignificant difference for the relative growth rate among the treatments compared (Table 4). Mustafa (2017) found highest relative growth rate at 3% (0.22). Moreover, in bitter gourd seed and bottle gourd seeds, Lima (2017) found relative growth rate in control/no priming (0.11).

Root: shoot ratio (dry weight basis)

There was insignificant difference for the root: shoot ratio among the treatments at all the three DADs(Table 4). Lima (2017) noted the maximum root: shoot ratio (0.34) in seedlings of yard long been observed from the seeds treated with the 1% H_2O_2. But the excessive accumulation of H_2O_2 leads to cellular oxidative damage and even programmed death (Levine *et al*., 1994 and Prasad *et al*., 1994) and thus becomes poisonous for seedlings.

Conclusions:-

It canbe concluded thatH_2O_2had optimistic effects on the seedling qualities. Again, among the six concentrations of the H_2O_2, 1%was the most effective one for sweet gourd and sweet gourd while 1.5% was suitable for radish seeds. Above those concentrations, others were somewhat toxic as those hindered a lot of the parameters evaluated.

References:-

1. Anonymous. (1993). Bangladesh Bureau of Statistics. Statistics Division, Ministry of Planning. Dhaka. pp. 189-190.
2. Gopalan, C., Rum, S.B.V., Ubramanion, B.S.C. (1982). Nutritive value of Indian Food. I.C.H.R., Hyderabad, India, referred by R.G. Smith, Home Economicst, M.C.C. pp. 23-29.
3. Tecson, A.M. (2001). Pumpkin production guide, Bureau of Plant Industry, Horticulture Section. Crop Research Division, Manila.
4. Kadam, P.V., Patil, M.J. (2014) Pharmacognostic study of *Cucurbita moschata*(cucurbitaceae). *Pharmacognosy J.* **5**: 201-209.
5. Nkosi, C.Z., Opaku, A.R. (2006). Antioxidant effects of pumpkin seeds (*Cucurbita pepo*) protein isolate in ccl4 included liver injury in low protein fed rats.
6. CL, F., Shi, H., Li, Q.H. (2006). A Review on Pharmacological Activities and Utilization Technologies of Pumpkin. Plant Foods Hum. Nutr. **61**: 73-80.
7. Afghani, M. B., and Taheri, G. 2012. A survey on the effect of seed priming on germination and physiological indices of cotton khordedcultivar. Ann. Biol. Res. 3(2): 1003-1009.
8. Black, M., Bewley, J. D., Halmer, P. 2006. The Encyclopedia of Seeds: Science, Technology and Uses. Wallingford: CABI.5-6
9. Bradford, K. J. 1986. Manipulation of seed water relations via osmotic priming to improve germination under stress conditions. Hort. Sci. 21: 1105-1112.

10. Coolbear, P. and McGill, C. R. 1990. Effect of low temperature pre-sowing treatment on the germination of tomato seeds under temperature and osmotic stress. *ScientiaHorticulturae*44: 43-54.
11. Copeland, L.O. and Mcdonald, M. B. 1985. Principles of seed science and technology. Macmillan Publishing Co. USA. P.3-5.
12. Demir, M., Kaya, G. K. andSuay, B. 2012. Comparison of seed priming efficiency on germination of high linoleic and high oleic acid contents in sunflower seed.World Acad. Sci. Eng. Technol. P. 69.
13. Deng, X. P., Cheng, Y. J., Wu, X. B., Kwak, S. S., Chen, W. and Eneji, A. E. 2012. Exogenous hydrogen peroxide positively influences root growth and metabolism in leaves of sweet potato seedlings. 6(11): 1572-1578.
14. El-Maarouf-Bouteau H. andBailly C. 2008. Oxidative signaling in seed germination and dormancy. Plant Signal. Bechav. 3. 175–182.
15. Finnerty, T. L., Zajicek, J. M. and Hussey, M. A. 1992. Use of seed priming to bypass stratification requirements of three Aquilegia species. Hort Science. 27: 310-313.
16. Hardegree, S. P. and Emmerich, W. E. 1992. Seed germination response of four south-western range grasses to equilibration at sub-germination matric potentials. Agronomy Journal.84: 994-998.
17. Iqbal, T.M.T., Bahadur, M.M., Kabir, M.A., Hasan, M.A. and Majumder, D.N.A. 2001. Improvement of sweet gourd seed quality by pre-soaking in H_2O_2 solution. Pakistan J. of Bio. Sci. 4(6): 639-641.
18. ISTA. 2010. International rules for seed testing (supplement rules). International Seed Testing Association (ISTA). Seed Sci. and Technol. 27: 25-30.
19. Jann, R. C. and Amen, R. D. 1997. What is germination? In: Khan A. A. (Ed.). The physiology and biochemistry of seed dormancy and germination, North Holland Publishing, Amsterdam, 7-28.
20. Jia, W., Wang, Y., Zhang, S. and Zhang, J. 2002. Salt-stress-induced ABA accumulation is more sensitively triggered in roots than in shoots. J. Expt. Bot. 53: 2201-2206.
21. John, R. and Duval. 2000. Treatment with hydrogen peroxide and seed coat removal or clipping improves germination of 'Genesis' triploid watermelon. Hort. Sc. 35(1): 85–86.
22. Kaya, D., M., Okçu, G., Atak, M., Çikili, Y. and Kolsarici, Ö. 2006. Seed treatment to overcome salt and drought stresses during germination in sunflower. Europ. J. of Agrn. 24: 291-295.
23. Knypl, J. S. and Khan, A. A. 1981. Osmo-conditioning of soybean seeds to improve performance at suboptimal temperatures. Agronomy Journal.73: 112-116.
24. Kranner, I., Chen, H. Y., Pritchard, H. W., Pearce, S. R. and Birtic, S. 2011. Seed ageing correlates with inter-nucleosomal DNA fragmentation and loss of RNA integrity. Plant Growth Regul. 63: 63–72.
25. León-Vargas, Julio, Guevara-Acevedo, Luis, Cervántes-ortíz, Francisco, Rodríguezmer-cado, Daniel, Cisneros-López, Hugo and Adrío-Enríquez and Enrique. 2016. Effect of hydrogen peroxide on broccoli seedlings. Ecorfan J. Equador, 3-5:7-13
26. Levine, A., Tenhaken, R., Dixon R. and Lamb, C. 1994. H_2O_2 from the oxidative burst orchestrates the plant hypersensitive disease resistance response. Cell. 7: 583-593.
27. Lima, I. J. 2017. Enhancing the seedling qualities of some vegetables priming with H_2O_2. An M. S. thesis, Dept. of Horticulture, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur. pp. 1-67.
28. Mustafa, H. 2017. Improving the seedling qualities of some vegetables priming withH_2O_2. An M. S. thesis, Dept. of Horticulture, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur. pp. 1-89.
29. Nandi, M., Pervez, Z., Alam, S., Islam, S. and Mahmud, R. 2017. Effect of hydrogen peroxide treatment on health and quality of chilli seed. Int. J. Pl. Pathol. 8: 8-13.
30. Ogawa, K. and Masaki, I. 2001. A Mechanism for promoting the germination of *Zinnia elegans* seeds by hydrogen peroxide. Plant cell physiol. 42(3): 286-291.
31. Ogiwara, H. and Terashima, K.2001. A varietal difference in coleoptile growth is correlated with seedling establishment of direct seeded rice in submerged field under low temperature conditions. Plant Prod. Sci. 4: 166-172.
32. Patade, V. Y., Maya, K. and Zakwan, A. 2012. Seed priming mediated germination improvement and tolerance to subsequent exposure to cold and salt stresses in capsicum. Res. J. Seed Sci. 4: 125–136.
33. Prasad, T. K., Anderson, M. D., Martin, B. A. and Stewart, C. R. 1994. Evidence for chilling-induced oxidative stress in maize seedlings and a regulatory role for hydrogen-peroxide. Plant Cell. 6: 65–74.
34. Schopfer, P., Plachy, C. and Frahry, G. 2001. Release of reactive oxygen intermeates (Superoxide radicles, H_2O_2 and hydroxyl radicles) and peroxides in germinating radish seeds controlled by light, gibberellins and abscisic acid. Pl. Physiol. 125: 1591-1602.

35. Taylor, A. G.andHarman, G. E. 1998. Concepts and technologies of selected seed treatments. Annu Rev Phytopathol. 28: 321–39.
36. Toselli, M. E. and Casenave, E. C. 2003. Water content and the effectiveness of hydro and osmotic priming of cotton seeds. Seed Sci. and Tech. 31: 727-735
37. Weitbrecht, K., Müller, K. and Leubner-Metzger, G. 2011. First of the mark: early seed germination. J. Exp. Bot. 62: 3289–3309.