EFFECT OF SEED SIZE, PLANT GROWTH REGULATORS AND SOME CHEMICAL MATERIALS ON GERMINATION CHARACTRISTICS AND SEEDLING VIGOUR OF RICE (*Oryza sativa* L.) SEEDS

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ABSTRACT

In order to evaluate the effect of seed size, plant growth regulators and some chemical materials on seed vigour and seedling growth of rice (*Oryza sativa* L.) an experiment was conducted in 2015 at Laboratories of Agriculture and Marshes College, University of Thi-Qar. Factorial experiment in CRD was used with four replications in two factors. The first factor included three seed sizes (4.6-5.1, 5.2-5.7 and 5.8-6.3 mm). The second factor was seeds soaking treatments (KNO_3 6 g.l^{-1}, $CaCl_2$ 20 g l^{-1} , salicylic acid 20 mg l^{-1}, cytokinin 40 mg l^{-1}, gibberllic acid 400 mg l^{-1} , ascorbic acid 40 mg l^{-1} and seeds soaked in distilled water). The results showed that the largest seed size influenced significantly and gave the higher averages of germination percentage in ageing acceleration test , germination speed index, germination percentage, radical length, plumule length and seedling vigour. The seeds rice that were soaked with gibberellic acid gave the higher averages of germination percentage in ageing acceleration test, germination speed index, germination percentage, radical length, plumule length and seedling vigour. The largest seed size which was soaked with gibberellic acid gave the higher averages of germination percentage in ageing acceleration test, germination speed index, germination percentage, radical length, plumule length and seedling vigour.

Key words: Rice, seeds size, seeds enhancement, germination percentage, seedling vigour.

INTRODUCTION

Rice considers as one of the important cereal crops in the world and the staple food for half of the world population .More than 2 billion people obtain more than %70 of their energy need depending on rice and its products. Sowing rice in many countries, especially Asian countries regard as a source of their income for the national economy (Febri *et al*., 2014). In addition, some of the countries attribute the development of their civilization to the sown and production of rice (Al-Lamy, 2014). In spite of that, the increasing of rice productivity is facing as many challenges in the world during in the third millennium. Thus, FAO estimated the rice productivity in 2025 about 140 million tons (FAO, 2008)

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Therefore, understanding the rice performance through its growth stages is very important to reduce and face all rice cultivation difficulties especially the seed germination and seedling emergence stages. The rice seeds are distinguished by a number of biological qualitative and physical features that influencing rice performance since the early growth stages of germination passing to the embryonic axes emergence to a full mature plant. The seed germination success requires to understand all the features influencing its quality and the seedling vigour, especially the seed of crop that facing many challenges causing reduction in its germination rates and the field behavior weakness rice crop seeds. Thus, rice seeds suffer from the poor activity of seeds enzymes and the solidness of the seed coat as well as its entry to secondary dormancy right after the harvesting (Al-Selawy, 2011). Some of these challenges can be overcome relatively, especially at the study of the biological phenomena, biological processes associated with the seed germination and the physical characteristics affecting the seeds. Moreover, seed size deemed as one of the physical criterions giving a clear idea about the quality and vigour of the seed. Many of the scientific sources illustrated that there is a positive correlation between the seed size and the ability of emergence (Zareian *et al*., 2013 ; Hossein *et al*., 2011; Mut & Akay , 2010) , because of the seed size influence on the physiological reactions and morphological changes associated with germination starting from seed imbibing to the radicle emergence stages. Regarded seed size is an indicator for the stored food forming the necessary potential energy for the embryo. This energy requires for the embryo activation and stimulation of germination process (Moshatati & Gharineh, 2012; Roy *et al*., 1996). The seeds rice treatment before sowing regarded as low-cost technique enhancing the cellular metabolism during germination stage increased seedling vigour and it emergence evenness (Hafeez *et al*., 2010 ; Basra *et al*., 2005). The seeds treatment chemically before sowing aims to stimulating most of the physiological and morphological activities during the germination stage which contributes to skip the secondary dormancy, improving the germination speed and increase the seedling vigour to grow in fast and regulate emergence within a wide range of the suitable environmental condition and environmental stress (Habib *et al*., 2010 ; Ruan & Tylkowska, 2002). Abd-albaki & Copeland (1997) indicated that the seed size considered one of the important factors effecting the wheat seed germination, seedling emergence and field establishment. Moreover, seed size and its protein content directly influenced the seed ability to germination and seedling growth that reflected the final yield. The big size seed

(25-30 mm) achieved high rate of standard germination percentage , seed vigour index and the field seedling emergence rate (Roy *et al*., 1996). Therefore, this reasons would increase the problems of rice cultivation especially if planting in the direct dry method. It is possible to overcome the problem through treating the rice seeds before sowing with chemical materials and plant growth regulators which enhance the seeds and increase their stimulation. The use of seed stimulation technique helps to improve the seed ability for germination and increases the speed of seedling emergence. The reason to treat the seed before sowing is due to enhance the biological reaction inside the seed like raising enzymes the activity to analyze the stored food and stimulate the process of dissolution food move to the seed embryo at the starting of the germination stage (Rehman *et al*., 2011; Habib *et al*., 2010; Basra *et al*., 2006; Farooq *et al*., 2006).

Therefore, the aim of this experiment was to study the effect of seed size and seed soaking treatments with plant growth regulators and some chemical materials on the germination and seedling growth of rice.

MATERIALS AND METHODS

A Laboratory experiment was carried out in 2015 at the College of Agriculture and Marshes laboratory to study the influence of seeds size and seeds soaking with the plant growth regulators and some chemical materials on the germination features and seedling vigour of rice (*Oryza sativa* L.). This study was conducted by using rice seeds amber-33 cultivar which was subjected their plants to similar environmental conditions and process of soil surface and its harvested in the late 2014 agricultural season. Testing of seed vigour and features of seedling vigour were conducted at the laboratories of College of Agriculture and Marshes, Thi-Qar University after taking a working sample from composite sample. Then, the seeds were sterilized in (%5) (V/V) sodium hypochloride for 5 minutes and thoroughly washed with a distilled water and was left for air dryness for 48 hours in the laboratories (Sozharajian & Natarajan, 2014 ; Bahrani & Pourreza, 2012 ; IRRI, 2011). A factorial experiment in CRD was used with four replications in two factors, the first factor is the seed size in three sizes (4.6-5.1, 5.2-5.7 and 5.8-6.3 mm), the second factor represented the seed soaking by a number of plant growth regulators and chemical materials for 24 hours for the purpose of stimulating the seeds on germination and improving the seedling features. The plant growth regulators and chemical material i.e. (KNO_3 6 g l^{-1}, $CaCl_2$ of 20 g l^{-1}, Salicylic acid 20 mg l^{-1}, Cytokinin 40 mg l^{-1}, Gibberellic acid 400 mg l^{-1} and Ascorbic acid 40 mg l^{-1} in addition to control treatment seeds soaked in distilled water only) were used. After the end of soaking period, the seeds were taken and air-dried for 24 hours. Then the following tests were conducted:

1- Accelerated Aging Test (AAT) (%)

Two hundred seeds were taken randomly out of each experiment. Then, they were put in a silk basket containing 40 ml of distilled water so that they do not touch it. The basket was sealed with a non- tight seal and was placed in the growth cabinet .The seeds were exposed to stress for 72 hours under the degree 43^o C $\pm$ 2 and a humidity percentage 100% (I.S.T.A , 2010).Then the seeds were taken and undergone to laboratory germination standard test by using growth cabinet at 25^o C and 95% humidity percentage .Then, only one was counted after 7 days from the day of germination to determine the number of natural seedlings and the results were transformed to percentage and recorded on the base that they were germination percentage by test of age acceleration according to the following equation (I.S.T.A , 2010):

$$AAT = \frac{the\ number\ of\ natural\ seedlings}{total\ number\ of\ seeds} \times 100$$

2- Germination Speed Index (GSI)

Two hundered pure seeds were taken from each treatment and they were cultivated in four replications on towels paper by folding methods. They were put at the growth cabinet in 25 ^{o}C and 95% humidity percentage. Natural seedlings were counted each day beginning from the fifth day from putting the seeds in growth cabinet until the end of test period 14 days then the indication of germination speed is measured according to the following equation (A.O.S.A, 1983):

$$GSI = \frac{no.of\ germination\ seed}{days\ of\ first\ count} + \cdots + \cdots + \frac{no.of\ germination\ seed}{days\ of\ final\ count}$$

3- Standard Germination Percentage Test (%)

The standard laboratory germination was measured by accounting the number of natural seedlings just after end of test period of 14 days by dividing the gross number of the natural seedlings at the end of test period on the gross number of the seeds (IRRI, 2011; ISTA 2010).

4- Radicle and Plumule Length (cm)

After the end of test time, 10 natural seedlings were taken. The radicle and plumule were separated from its connecting point with seed coat. Then, the radicle and plumule were measured (cm) and average was concluded for these two features (Febri *et al*., 2014 ; I.S.T.A, 2010).

5- Seedling Vigour (SV)

The seedlings vigour was measured by the following equation (Febri *et al*., 2014; Majid *et al*., 2013)

SV= Germination Percentage (%) × [radicle length (cm) + plumule length (cm)]

All data were analyzed statistically by analysis of variance (ANOVA) using Genstat software and averages of the main effect and their interactions were compared using the least significant difference test (LSD) at 5 % level of probability (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Germination Percentage in Age Acceleration Test (%)

Seeds exposure to stress conditions such as raised temperature and relative humidity for certain period of time in age acceleration test aide in determine vigour and performance of these seeds. The strong seeds are the seeds that resist stress condition and produce high rate of natural seedlings .Results of variance analysis indicated significant effect of seed size, seed soaking treatments and their interaction on the germination percentage in ageing acceleration (Table 1) .The largest seeds size achieved the highest germination percentage in ageing acceleration (11.52%) while, smallest seed size recorded lower mean of this feature amounted to 8.90%. These results may be attributed to the fact that the largest seeds contain large store of nutrient which is considered necessary for providing the embryo by the energy to activate and stimulate it for germination and that makes the big size seeds perform a perfect act and homogenous emergence (Roy *et al*. 1996). This result agreed with Chaffai & Louhich (2013); Zareian *et al*. (2013) and Hossein *et al*. (2011) who indicated the concept that explain that largest seeds size have highest vigour then other seeds size. Seed soaking treatments significantly affected on germination percentage in ageing acceleration. The seeds that were soaked by gibberellic acid recorded higher mean for this feature which amounted to 13.56 % and it was not significantly different with seeds soaked by cytokinin. This may be attributed to the fact that the seed germination and the emergence of seedling under stress conditions requires active enzyme system with building and demolishing processes during germination process. It was found that the synthesis of the system is under the control of plant hormones especially the gibberellin that controls the organizing and synthesis α-amylase enzyme by the accumulation of mRNA and gibberellic acid may direct certain genes that work on synthesis other enzymes that includes protease and nuclease by digesting the nucleic acid. These enzymes transport it to the endosperm and saccharides, amino acid and the nucleotides were formed. These nutrition products were transported to the embryo that was reflected positive on the activation of metabolism during seed germination stage (Al-Selawy, 2011 ; Attiya & Jaddoa, 1999 ; Phinney, 1983). This result agreed with the findings of other researchers (Zare & Zadeh, 2007 ; Farooq *et al*., 2006) who indicated that seeds soaking pre-sowing by gibberellic acid increase the viabiliity and vigour of rice seeds which would be reflected positively on the ability of germination. The largest seed size which were soaked by gibberellic acid exceeded significantly on the germination percentage in ageing acceleration and It achieved the highest mean amounting to 15.88% without being significant difference with the largest seeds which were soaked by cytokinin which is an indication on the ability of proving the viability and vigour of largest size seeds as well as increase the ability of performance during germination stage though soaking it with plant growth regulators especially gibberellic acid and cytokinin which were considered the important germination vigourous stimulators. This result agreed with other workers (Zare & Zadeh, 2007 ; Iqbal & Ashraf, 2005) who indicated that seeds soaking before sowing with gibberellic acid and cytokinin which enhancement the seeds and improving their performance and the ability of germination treating them. The smallest seeds size which soaked by $CaCl_2$ recoded less mean of this feature amounting to (7.51%).

Table 1. Effect of seed size, seeds soaking treatments and their interaction on germination percentage in age acceleration test (%) of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	7.79	8.24	9.62	8.55
Cytokinin 40 $mg.l^{-1}$	10.81	12.13	13.45	12.13
Salicylic Acid 20 $mg.l^{-1}$	8.50	10.33	11.63	10.15
Ascorbic Acid 40 $mg.l^{-1}$	8.12	9.55	11.25	9.64
Gibberellic acid 400 $mg.l^{-1}$	11.54	13.26	15.88	13.56
KNO_3 6 $g.l^{-1}$	7.98	9.45	10.12	9.18
$CaCl_2$ 20 $g.l^{-1}$	7.51	8.48	8.70	8.23
L.S.D 5%	1.83			1.29
Mean	8.90	10.21	11.52	
L.S.D 5%	1.11			

Germination Speed Index Test

The results showed that the effect of seed size was significant on germination speed index (Table 2). The largest seeds size had highest germination speed index in compared to other seed size and its achieved 24.27. While, the smallest seeds size showed lower mean for this feature which amounted to 17.74. This may be attributed to that the size of large seeds means nutrition store and the largest surface porous which gave the ability for seed to faster and efficient water imbibition which gave the large seeds better performance which positively reflected on the germination speed. Seed soaking treatments influenced significantly on germination speed index. The soaked seeds by gibberellic acid recorded higher mean for this feature which amounted to 29.02 and it was not significantly different with seeds soaked by cytokinin. This was attributed to the fact that the gibberellic acid specially gibberellic GA3 are considered most germination stimulators within wide range from plant species (Attiya & Jaddoa, 1999 ; Phinney, 1983). Also, cytokinin has an important role in organizing seed germination through its mediation in cloning RNA as well as cytokinin role in increasing permeable of seeds membrane and their stimulate germination (Zare & Zadeh, 2007; Iqbal & Ashraf, 2005) .

Table 2. Effect of seed size, seeds soaking treatments and their interaction on germination speed index of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	16.92	17.13	20.51	18.19
Cytokinin 40 $mg.l^{-1}$	19.67	28.11	32.20	26.66
Salicylic Acid 20 $mg.l^{-1}$	17.40	19.06	24.35	20.27
Ascorbic Acid 40 $mg.l^{-1}$	17.13	18.06	21.90	19.09
Gibberellic acid 400 $mg.l^{-1}$	22.62	30.01	34.43	29.02
KNO_3 6 $g.l^{-1}$	17.56	17.77	20.85	18.73
$CaCl_2$ 20 $g.l^{-1}$	12.71	13.13	15.62	13.82
L.S.D 5%	3.21			1.87
Mean	17.74	20.47	24.27	
L.S.D 5%	1.60			

The largest seed sizes which were soaked by gibberellic acid exceeded significantly in the germination speed index and achieved higher mean of this feature amounted to 34.43 while, the smallest seeds size which soaked by $CaCl_2$ recoded less mean of this feature amounting to 12.71.

Standard Germination Percentage (%)

Seed size had significant influence on standard germination percentage (Table 3). The highest and lowest standard germination percentage was occurred in largest seeds size and smallest seeds size (86.89% and 71.80%), respectively. This may be attributed to the fact that largest seeds size is characterized by their large surface area that allows them to be water imbibition in an efficient and quicker manner in their first stage of germination as well as its high content carbohydrate and proteins. Its high capability for speedy supply to the embryo by the necessary stored nutrition to stimulate germination. This result agreed with other workers (Zareian *et al*., 2013 ; Hossein *et al*., 2011 ; Kaydan & Yagmur, 2008 ; Lafond & Baker, 1986) who indicated that there is a significance increase in viability and vigour of rice seeds with the increase of seeds size that contributes in giving higher germination percentage. Seeds soaked by gibberellic acid exceeded significantly compared to the others soaking treatment in standard germination percentage and it achieved higher mean of this feature amounting to 89.57% without being significantly difference with seeds soaked by cytokinin which recorded germination percentage amounted to 86.04%, that might be attributed to the fact that soaking rice seeds with plant growth regulator, especially cytokinin and gibberellin pre sowing help in stimulation of most physiological activity and morphological changes in the seed, especially in the earlier germination stages that contribute in surpassing seed secondary dormancy and improve germination percentage and germination speed. The percentage is within the wide range of suitable conditions and the conditions of environmental stress, this result agreed with the findings of other researchers (Ken & Jun, 2013; Zare & Zadeh, 2007).

Table 3. Effect of seed size, seeds soaking treatments and their interaction on standard germination percentage (%) of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	70.31	75.60	83.45	76.45
Cytokinin 40 mg.l^{-1}	76.46	89.73	91.92	86.04
Salicylic Acid 20 mg.l^{-1}	72.11	80.03	86.81	79.65
Ascorbic Acid 40 mg.l^{-1}	67.80	76.81	81.64	75.42
Gibberellic acid 400 mg.l^{-1}	79.97	92.45	96.30	89.57
KNO_3 6 g.l^{-1}	70.57	78.76	84.97	78.10
$CaCl_2$ 20 g.l^{-1}	65.41	76.66	83.17	75.08
L.S.D 5%	7.98			4.50
Mean	71.80	81.43	86.89	
L.S.D 5%	5.27			

Also, the superiority of the soaking seeds by gibberellic and cytokinin on standard germination percentage were attributed to their superiority on germination speed index. The lower means of this feature was 75.08% for the seeds soaked by $CaCl_2$. Results of variance analysis indicated significant effect of interaction between seed size and seed soaking treatments on standard germination percentage (Table 3).

Largest seeds size that soaked with gibberellic acid achieved higher mean of standard germination percentage which amounted to 96.30 %, while, the smallest seeds size soaked by $CaCl_2$ achieved lower mean which amounted to (65.41 %). This result is considered logical because the larger seeds size which soaked with gibberellic acid and larger seeds size which soaked with cytokinin attained higher means of germination speed index feature (Table 2). That was positively reflected on standard germination percentage.

Radicle Length (cm)

The results showed that the effect of seed size was significant on radicle length (Table 4). The higher mean of radicle length was occurred in largest seeds size (10.81 cm). That may be attributed to largest seeds size achieved higher means for germination speed index and standard germination percentage features (Table 2 and 3). This contributes in giving them vigour seedlings grew and developed in a manner better in comparisons with seeds of other sizes. This is another index that approve the largest seeds size figure as the vigour seeds have maximum radicle length, this result agreed with the finding of other researchers (Chaffai & Louhich, 2013 ; Zareian *et al*., 2013 ; Mut & Akay, 2010). The lower mean of radicle length was recorded by smallest seeds size (7.96 cm).

Table 4. Effect of seed size, seeds soaking treatments and their interaction on radicle length (cm) of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	7.26	8.55	10.10	8.64
Cytokinin 40 $mg.l^{-1}$	8.94	9.81	12.07	10.27
Salicylic Acid 20 $mg.l^{-1}$	8.13	9.70	11.10	9.64
Ascorbic Acid 40 $mg.l^{-1}$	6.20	8.24	9.76	8.07
Gibberellic acid 400 $mg.l^{-1}$	8.78	10.03	12.64	10.48
KNO_3 6 $g.l^{-1}$	8.37	9.16	10.57	9.37
$CaCl_2$ 20 $g.l^{-1}$	8.05	8.62	9.40	8.69
L.S.D 5%	1.42			0.87
Mean	7.96	9.16	10.81	
L.S.D 5%	1.13			

Seed soaking treatments influenced significantly on radicle length. The seeds that were soaked by gibberellic acid recorded higher mean for this feature which amounted to 10.84 cm and it was not significantly different with seeds soaked by cytokinin and salicylic acid. That may be attributed to the influence of gibberellic acid and cytokinin in seed germination acceleration and emergence of radicle and plumule that gave them a greater opportunity to grow during the test. This agreed with Habib *et al*. (2010), Zare & Zadeh (2007), Iqbal & Ashraf, (2005) and Ruan & Tylkowska (2002) who indicated that the seed that were stimulated pre sowing by gibberellic acid and cytokinin where germination was speedier and it produced the longest radicle. The largest seeds size that soaked with gibberellic acid exceeded significantly and achieved higher mean of the radicle length that amounted to 12.64 cm, while, the smallest seeds size soaked by ascorbic acid achieved lower mean which amounted to 6.20 cm.

Plumule Length (cm)

Seed size, seeds soaking treatments and their interaction significantly affected on plumule length (Table 5).The highest plumule length was occurred in largest seeds size (10.04 cm). That was attributed to the fact that high nutrition store of larger seeds and their main role in raising the seed vigour and increase the averages embryonic axes growth to shoot and root contribute in achieving higher means of radicle and plumule length. This result consistent with Willenborag (2005) and Roy *et al*. (1996). While, smallest seeds size showed lower mean for this feature which amounted to 6.94 cm.

Table 5. Effect of seed size, seeds soaking treatments and their interaction on plumule length (cm) of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	6.25	7.73	9.17	7.72
Cytokinin 40 $mg.l^{-1}$	7.53	9.91	11.54	9.66
Salicylic Acid 20 $mg.l^{-1}$	7.32	9.20	9.78	8.77
Ascorbic Acid 40 $mg.l^{-1}$	6.20	7.35	8.50	7.35
Gibberellic acid 400 $mg.l^{-1}$	7.66	9.89	11.90	9.82
KNO_3 6 $g.l^{-1}$	7.50	10.10	10.81	9.47
$CaCl_2$ 20 $g.l^{-1}$	6.15	7.45	8.59	7.10
L.S.D 5%	1.55			1.10
Mean	6.94	8.80	10.04	
L.S.D 5%	1.26			

Seed soaking treatments had significant enfluence on the plumule length feature. The seeds soaking in gibberellic acid achieve higher mean amounted to 9.82 cm without being significantly difference with seeds soaked by cytokinin and salicylic acid. This result is considered reasonable for the increasing average of standard germination percentage for the seeds which soaked in gibberellic acid and the seeds which soaked with cytokinin (Table 3). Which contributed to give a strong seedlings that grew and developed in a better way in comparison with other soaking treatments. This result agreed with Bahran & Pourreza (2012), Iqbal & Ashraf (2005) and Mathew & Mohanasarida (2005) who indicated that seeds soaked with gibberellic acid and cytokinin was speeder in germination and plumule emergence. Seeds soaked with CaCl2 gave lowest plumule length which amounted to 7.10 cm. The largest seeds size that soaked with gibberellic acid achieved higher mean of this feature which amounted to 11.90 cm, while, the smallest seeds size soaked by $CaCl_2$ achieved lower mean which amounted to 6.15 cm.

Seedling Vigour

Results of variance analysis indicated significant effect of both studied factors and their interaction (Table 6). The largest seeds size had highest seedling vigour in compared to other seed size and its achieved 1822.54. While, smallest seeds size showed lower mean for this feature which amounted to 1075.36. That may be attributed to the increasing average of physiological and morphological activity of large seeds size because of the increasing average of its water imbibition and the increasing in supplement of the embryo with the digested nutrition essential to stimulate the seeds of germination and encourage the emergence of the embryonic axes and that was reflected positively on seedling vigour. This result agreed with Zareian *et al*. (2013) Kaydan & Yagmur (2008) and Royo *et al*. (2006) who indicated that the largest seeds size were better in seedling vigour. Seed soaking treatments were different significantly in seedling vigour.

Seeds soaked by gibberellic acid achieved higher mean of this feature amounted to 1839.84. It was not different significantly with seed soaked by cytokinin, that might be attributed to the fact that soaking rice seeds with plant growth regulator, especially gibberellin and cytokinin stimulation led to an increase in germination percentage and germination speed index (Table 2 and 3) as well as it contributed in stimulating the growing of embryonic axes which gave the best means of seedling features. This result agreed with the findings of other researchers (Zare & Zadeh, 2007 ; Farooq *et al*., 2006 ; Phinney, 1983). While, seeds soaked with ascorbic acid gave a lower mean of this feature which amounted to 1176.31. The largest seeds size that soaked with gibberellic acid exceeded significantly and achieved higher mean of the seedling vigour that amounted to 2363.20, while, the smallest seeds size soaked by ascorbic acid recorded lower mean which amounted to 840.72. In general, it is observed in (Table 6) that the general direction of gibberellic acid and cytokinin is in the seedling vigour increase even in the small size seeds.

Table 6. Effect of seed size, seeds soaking treatments and their interaction on seedling vigour of rice seeds

Soaking treatments	Seed size(mm)			Mean
	4.6-5.1	5.2-5.7	5.8-6.3	
Distilled water	949.89	1230.77	1608.08	1262.91
Cytokinin 40 $mg.l^{-1}$	1259.30	1769.48	2170.23	1733.00
Salicylic Acid 20 $mg.l^{-1}$	1114.10	1512.60	1812.60	1479.77
Ascorbic Acid 40 $mg.l^{-1}$	840.72	1197.47	1490.75	1176.31
Gibberellic acid 400 $mg.l^{-1}$	1314.71	1841.60	2363.20	1839.84
KNO_3 6 $g.l^{-1}$	1119.95	1516.92	1816.66	1484.51
$CaCl_2$ 20 $g.l^{-1}$	928.82	1231.93	1496.23	1218.99
L.S.D 5%	212.71			115.45
Mean	1075.36	1471.54	1822.54	
L.S.D 5%	143.26			

CONCLUSION

Assessment of treatment in this study showed that seed size had significant influence on standard germination percentage and most seedling characteristics .The germination percentage in ageing acceleration test , germination speed index , germination percentage , radical length, plumule length, seedling vigour and increased by increasing seed size .The rice seeds vigour can be improved and enhanced to some extent when soaked with gibberellic acid and cytokinin.Based on the results, it can be concluded that largest seeds size soaked with gibberellic acid and cytokinin have more positive effects on rice seeds vigour.

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تأثير حجم البذرة ومنظمات النمو النباتية وبعض المواد الكيميائية في خصائص الانبات ونمو بادرات الرز (*Oryza sativa* L.)

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المستخلص

تهدف هذه الدراسة الى معرفة تأثير حجم البذرة و معاملات النقع بمنظمات النمو النباتية و بعض المواد الكيميائية في قوة البذرة و نمو بادرات الرز. طبقت التجربة في مختبرات كلية الزراعة و الاهوار – جامعة ذي قار عام 2015 باستعمال تصميم تام التعشية للتجارب العاملية بأربعة مكررات بعاملين، العامل الاول تضمن حجم البذرة بثلاثة احجام و هي (4.6-5.1 , 5.2 -5.7 , 5.8 -6.3 ملم)، اما العامل الثاني فشمل معاملات النقع وهي (KNO_3 6 غم.لتر$^{-1}$ و $CaCl_2$ 20 غم لتر$^{-1}$ و salicylic acid 20 ملغم لتر$^{-1}$ و cytokinin 40 ملغم لتر$^{-1}$ و gibberllic acid 400 ملغم لتر$^{-1}$ و ascorbic acid 40 ملغم لتر$^{-1}$ وبذور منقوعة بالماء المقطر فقط). اظهرت نتائج التجربة تفوق بذور الرز كبيرة الحجم معنوياً بتسجيلها اعلى المتوسطات لصفات نسبة الانبات في فحص تعجيل العمر ودليل سرعة الانبات ونسبة الانبات المختبري القياسي وطول الجذير وطول الرويشة وقوة البادرة والوزن الجاف للبادرة. حققت بذور الرز المنقعة بحامض الجبرليك اعلى المتوسطات لصفات نسبة الانبات في فحص تعجيل العمر ودليل سرعة الانبات ونسبة الانبات المختبري القياسي وطول الجذير وطول الرويشة وقوة البادرة والوزن الجاف للبادرة. تفوقت بذور الرز كبيرة الحجم المنقعة بحامض الجبرليك على بقية التداخلات الاخرى معنوياً بتسجيلها اعلى المتوسطات لصفات نسبة الانبات في فحص تعجيل العمر ودليل سرعة الانبات ونسبة الانبات المختبري القياسي وطول الجذير وطول الرويشة و قوة البادرة.

الكلمات المفتاحية: محصول الرز، حجم البذور، تحفيز البذور، نسبة الانبات، قوة البادرة.