Seed Germination Behaviors Of Some Aerobic Rice Cultivars (Oryza Sativa L) After Priming With Polyethylene Glycol-8000 (Peg-8000)

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Abstract: Seed Priming Is Famous Technique To Accelerate Seed Germination Behaviors. This Experiment Was Conducted To Study The Effect Of Polyethylene Glycol-8000 (Peg-8000) As Priming Agent On Seed Germination Behavior Of Some Aerobic Rice Cultivars (Oryza Sativa L). Experiment Was Carried Out By Using Two-Factor (Three Aerobic Rice Cultivars And Peg) With Four Replications, Which Arranged In Factorial System Design And Conducted With Completely Randomized Design. The Factor Was Varieties Which Were Inpago 8 (V1), Ir64 (V2) And Situbagendit (V3), Combine With 4 Levels Of Peg Concentrations (0,100, And 200 Gl-1) And Control With No Treatment. Experiment Was Repeated 4 Times So Total Number Of Experimental Units Were 48). Germination Parameters Measured Were Germination Percentage, Germination Index, Days Of 50% Germination, Seedling Fresh Weight (Mg), Seedling Shoot Fresh Weight And Root Fresh Weight (Mg), Seedling Dry Weigh (Mg), Seedling Shoot Dry Weight And Root Dry Weight (Mg), Shoot/Root Ratio, Seedling Length (Cm), Seedling Root Length (Cm) And Shoot Length (Cm) And Seed Vigor Index. The Results Indicated That Seed Priming Significantly Affected Germination Behaviors Compared With Control Depending Upon Varieties. The Highest Germination % Was Obtained Under Laboratory And Greenhouse Condition By The Treatment Of Peg 200 G L-1 On The Situbagendit And Ir-64 Variety (90.25% And 93.33%, Respectively), Compared To Control In Inpago-8 In Both Laboratory (75.75%) And Greenhouse (80%) . As Implementation To Increase Seed And Seedling Vigor Of Rice It Is A Best Practice To Use Peg Priming With 200 Gl-1 Solutions Depend Upon Varietal Response, And We Suggest That More Research About The Effect Of Peg As Seed Priming Techniques On Seed Germination Behavior Of Many Grain Crops Is Needed To Confirm The Methodology.

Keywords: Aerobic Rice. Peg-8000, Seed Germination, Seed Priming

1 INTRODUCTION

There were many technologies that could progress and accelerate seed germination behaviors. Seed priming is a common one, which its general purpose is to partially hydrate seeds to a point where germination processes are initiated but not completed. Otherwise seed priming is defined as a pre-germination seed treatment in which seed are held at a solution that allow imbibitions, but prevents radical extension (Dell Aquila and Tritto, 1991; Giri and Schilinger, 2003; Kaur, 2002; Bardford, 1986; Mehadi et al., 2008). Beside that a concept said that most priming treatments involve imbibing seed with restricted amounts of water to allow sufficient hydration and advance of metabolic processes but preventing the protrusion of the radical (Ashraf and Foolad, 2006; Pegah et al., 2008). This technique is used for improvement of germination speed, germination vigor, seedling establishment and yield (Talebian et al., 2008; Bodsworth and Bewley, 1981). There are some studies on the effect of polyethylene glycol-8000 (PEG-8000) as seed priming techniques on seed germination behavior of some cereal crops such as sorghum, maize, wheat and rice.

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Basra et al. (1989) found that priming seed using polyethylene glycol resulted in accelerated germination behavior. Earlier works showed that the success of seed priming is influenced by the complex interaction of factors including plant species, water potentiality of the priming agent, duration of priming, temperature, seed vigor and dehydration, and storage conditions of the primed seed (Parera and Cantliffe, 1994; Mubshar et al., 2006). Aerobic rice (Oryza sativa L.) is a concept to cultivate rice like irrigated upland crops such as wheat or maize to reduce water inputs in lowland paddy field. To achieve a more resistance cultivar to water scarcity that could reduce rice production in the future, we need to "train" aerobic rice seed to grow under drought conditions through after priming treatment with PEG which play specific role under water stress approach. The objective of the present study was to show improved germination behaviors of some aerobic rice cultivars after treatment of polyethylene glycol-8000 (PEG-8000) as seed priming agent.

2 . MATERIAL AND METHODS

2.1 Location and description of experimental layout

Experiments were conducted in laboratories and greenhouse of the Department of Agronomy, Faculty of Agriculture, Hasanuddin University, Makassar, Indonesia during 2015. Aerobic rice seed of three varieties which were Inpago 8, IR64 and Situbagendit obtained from Indonesian Center for Rice Research (ICCR) in Sukamandi, Indonesia. Seed Moisture content was determined by grinding the seeds and then drying at 130°C for 4 h (ISTA, 2008) and calculated on a fresh weight basis. The seeds were surface sterilized with 5% NaOCl (sodium hypochlorite) for 5 min to avoid fungal invasion. Seed primed in 3 levels of PEG concentration i.e., 0, 100, 200 g L^{-1}, with osmotic potential equivalent to 0, - 0.2, and - 0.5 MPa, respectively (Michel, 1983; Ahmad et al., 2008), except for the control treatment (un-primed). Experiment was carried out by using two-factor (three aerobic rice cultivars and PEG) with four replications, which located in factorial system design and conducted with completely randomized design. The factor was varieties which were Inpago 8, a new potential variety as V1; IR64 a susceptible aerobic rice cultivars (V2); and Situbagendit, normal aerobic rice cultivars (V3), combine with 4 levels of PEG concentration (0,100, and 200 gL^{-1}) as P1, P2 and P3 respectively and control with not treatment (P0). Combinations of treatments equals to 12. Total numbers of experimental units were 48. After treatment, seeds were given three times surface washings with distilled water to cleanse PEG residue and re-dried to original moisture content.

2.2. Germination test:

One hundred seeds from each of the treatments were placed in 90-mm-diameter Petri dishes on Whatman No.2 filter paper moistened with 10 mL of distilled water. Seed was kept at room temperature 25 ^{O}C under normal light. Germination parameters measured and calculated daily and continued until fixed state, 7 days after planting as final germination behaviors (ISTA, 1993 and ISTA, 1999).

2.3. Emergence test:

Treated and control seeds were sown in 35 x35 cm plastic trays (40 in each) having moist sand, replicated three times and were placed in greenhouse. Factorial system was designed and conducted in the base of completely randomized design. Germination parameters measured and calculated daily and continued until fixed state, 15 days after sowing as final emergence behaviors according to Handbook of Association of Official Seed Analysts (1990).

2.4. The Germination parameters:

2.4.1. Germination Percentage (G %):

Calculated daily and continued until fixed state, 7 days after according to ISTA (1993 and 1999).

2.4.2. Means Germination Time (MGT):

Was calculated according to the equation of Ellis and Report (1981) as

$$MGT = \sum Dn/\sum n$$

Where:

N: number of seed which germinated on day n

D: the number of days counted from the beginning of germination

2.4.3. Germination Index (GI):

Was calculated according to the following formula

GI = Number of germinated seeds/Days of first count+……+ Number of germinated seeds/Days of final count

2.4.4. Days of 50% Germination:

The time to reach 50% germination was calculated according to the following formula of Coolbear et al. (1984) modified by Farooq et al. (2005)

$$\text{Germination } 50\% = t_i+[(N/2-n_i)(t_j-t_i)]/(n_j-n_i)$$

Where:

N: the final number of germination

n_i, n_j: cumulative number of seed germinated by adjacent counts at time when $n_i < N/2 < n_j$

2.4.5. Seedling, Shoot and Root Fresh Weight (mg):

Whole seedling, seedling shoot and root fresh weight (mg), of seedlings were recorded after 7 and 15 days in laboratory and greenhouse respectively after sowing and the means was calculated.

2.4.6. Seedling, Shoot and Root Dry Weight (mg):

Dry Weigh (mg) of whole seedling, shoot and root were recorded after 7 and 15 days in laboratory and greenhouse respectively after sowing and the means was calculated.

2.4.7. Seedling, Shoot and Root Length (cm):

Seedling Length, shoot and root length (cm) were recorded after 7 and 15 days in laboratory and greenhouse respectively after sowing and the means was calculated.

2.4.8. Seed Vigor Index:

Seed vigor index was calculated by multiplying germination % and seedling length (cm) so highest Seed Vigor was considered to be more vigorous. (Abdul-Baki and Anderson, 1973).

Seed Vigor index= germination% × seedling length (cm)

2.4.9. Shoot/Root Ratio:

Shoot/Root ratio was calculated using the following formula (Wood, A.J. and Roper, J. 2000).

$$\text{Shoot/Root Ratio: } = \frac{\text{dry weight for top of plant}}{\text{dry weight for roots}}$$

2.5. Data analysis:

All data analyses was carried out using slandered analysis of variance techniques (Gomez and Gomez, 1984) using SPSS statistical package software version 21 and means significant difference were separated using Duncan's multiple range test (Duncan's test)

3 Results and Discussion

3.1. Effect of PEG under laboratory condition

3.1.1. Germination Percentage (G %)

Results regarding G % of some aerobic rice cultivars under laboratory conditions affected by PEG, had no significance between varieties (V) and interaction of varieties × priming agent concentration (P) but there was a very highly significant between priming concentration (P). The highest germination percentage was obtained by the treatment V3P3 (90.25%) and the lowest by the treatment V1P0 (75.75%) (Table 1).

3.1.2. Germination Index (GI)

Analysis of variance showed differential influence of PEG on GI of some aerobic rice cultivars. Analysis indicated that there was a very highly significant between varieties (V), between priming concentration (P) and interaction within (V x P). The maximum and minimum effect recorded by the treatments (V3P3) and (V1P0) which were 44.83 and 25.30 respectively (Table 1).

3.1.3. Days of 50% Germinations

Statistical analysis showed that there was a very highly significance effect between varieties (V), interaction (V × P) and only significant between seed priming concentration (P). Among treatments, the treatments (V2p3, V3p1, V3p2 and V3P3) reported the shortest germination time after 2 days and V1P0 treatment was the longest one which was 4 days (Table 1).

3.1.4. Means Germination Time (MGT)

The effect of different PEG management on MGT of some aerobic rice cultivars cleared there was a very highly significance effect between varieties (V) and priming concentration treatment (P) and even in interaction (V × P). MGT was substantially highest for treatments V3P3, where about 5.58compared with lowest one that was about 2.86 recorded by the treatment (V1P0) (Table 1).

3.1.5. Seedling, Shoot and Root Fresh Weight (mg)

Result showed the influence of different PEG concentrations on Seedling Fresh Weight (SFW) (mg) of some aerobic rice cultivars indicating that there was no significant difference between varieties (V) and between interactions of varieties (V) × priming (P) but there was a very highly significant difference between seed priming concentration treatments (P). Seedling Fresh Weight (mg) was highest by the treatment V2P3 (32.72 mg) and lowest value obtained at treatment V3P2 (18.05 mg) (Table 2).

Table 1. *Means of Some Seed Germinations Parameters (Germination Percentage, Germination Index (GI), Days Of 50% Germination and Means Germination Time (MGT)) under PEG Effect.*

Treatments	G%	(GI)	50%	(MGT)
V1p0	75.75	25.30^{g}	4^{a}	2.86^{g}
V1p1	82.5	32.90^{de}	3^{c}	4.33^{d}
V1p2	84.75	34.30^{cd}	2.75^{c}	4.49^{cd}
V1p3	84.75	34.37^{cd}	2.75^{c}	4.51^{cd}
V2p0	80	27.33^{fg}	3^{c}	3.33^{fg}
V2p1	84.75	31.37^{def}	3^{c}	4.18^{de}
V2p2	85.25	29.72^{efg}	3^{c}	3.71^{ef}
V2p3	86	42.22^{ab}	2^{d}	5.72^{a}
V3p0	77.25	25.63^{g}	3.5^{b}	3.05^{g}
V3p1	86	38.10^{bc}	2^{d}	5.01^{bc}
V3p2	88.5	40.75^{ab}	2^{d}	5.31^{ab}
V3p3	90.25	44.83^{a}	2^{d}	5.58^{ab}
SE±	2.55	2..05	0.155	0.195

Figures not sharing the same letters differ significantly at p< 0.05.

Table 2 showed the importance of different levels of PEG on Seedling Shoot Fresh Weight (SSFW)**,** (mg) of some aerobic rice cultivars. Data analysis highlighted that there was normal significant difference between varieties (V) and a very highly significant difference between seed priming (P) but there was no significant difference between interactions (V) × seed priming concentration (P). Seedling shoot fresh weight was highest by the treatment V1P3 (6.48 mg) and lowest value obtained was at treatment V3P1 (1.50 mg). The performance of Seedling Root Fresh Weight (SRFW) (mg) of some aerobic rice cultivars under PEG influence, pointed out a very significant difference between seed priming concentration treatments (P) but there was no significant difference between varieties (V) and the Interactions between varieties (V) × seed priming (P)). Largest number of Seedling Root Fresh Weight (mg) was recorded by the treatment V3P3 (26.55 mg) and the narrowed one by the treatment V3P0 (13.26 mg) (Table 2).

3.1.6. Seedling, Shoot and Root Dry Weight (mg)

The priming of some aerobic rice cultivars seed under PEG conditions was reflected on Seedling Dry Weight (SDW)**,** (mg). There was significant difference between varieties (V) and between interactions of varieties (V) × seed priming (P). However, there was no significant difference between seed priming treatments (P). Biggest value was gained by treatments V1P3, V2P2, and V2P3 (approximately 12 mg) and smallest by V3P0 (8.75 mg) (Table 2). Results regarding Seedling Shoot Dry Weight (SSDW) (mg) as response to PEG had no significant difference between varieties (V) and between interactions (varieties (V) × seed priming (P) but there was significant difference between seed priming (P). The oldest Seedling Shoot Dry Weight (mg) was obtained by the treatment V2P2 which was 4.25 mg and the youngest by the treatments V1P0 and V3P1 which was 1.25 mg (Table 3). Data analysis showed differential influence of PEG on Seedling Root Dry Weight (SRDW) (mg) of some aerobic rice cultivars which indicated that there was no significant difference between varieties (V) and between seed priming (P) but there was a very highly significant difference between interaction (V × P). The greatest and lowest effects were recorded by the treatments V2P0 and V3P0 with V1P2 which were 12 and 7 mg respectively (Table 3).

3.1.7. Shoot/Root Ratio

Data provided the effect of PEG on Shoot/Root Ratio of some aerobic rice cultivars. Results showed that there was no significant difference between varieties (V), seed priming (P) and interaction (V × P). Among treatments, the treatment V2P2 reported the highest value of Shoot/Root ratio (0.137) and V1P0 treatment was the lowest one which was 0.030 (Table 3).

3.1.8. Seedling, Shoot and Root Length (cm)

The effect of different PEG management on seedling length (cm) of some aerobic rice cultivars revealed that there was no significant difference between varieties (V), but there was a very highly significant difference among seed priming treatments (P) and the interaction (V × P). Seedling length (cm) was substantially longest for treatment V2P0 (13.46 cm) compared with shortest one that was only about 8.69 cm which was recorded by the treatment V2P2 (Table 4). The influence of different PEG concentrations on seedling shoot length (cm) of some aerobic rice cultivars were shown here. PEG priming treatment had a very highly significant difference between varieties (V) and between interactions (varieties (V) × seed priming (P)), hence there was significant difference between seed priming (P). Seedling shoot length (cm) was longest by the treatment V3P3 (5.45 cm) and shortest value was obtained by treatment V1P0 (3.31cm (Table 4). Table 3 shows calculated importance of different levels of PEG on seedling root length (cm) of some aerobic rice cultivars. The data analysis highlighted that there was no significant difference between varieties (V) but there was a very significant difference in interactions of varieties (V) × seed priming (P), and by seed priming treatment alone (P). Seedling root length (cm) value was recorded highest by the treatment V2P0 (8.08 cm) and lowest value was obtained by the treatment V3P2 (4.46 cm)(Table 4).

3.1.9. Seed Vigor Index

Priming of some aerobic rice cultivars seed under PEG condition and it's expression on seed vigor assessed that there was no significant difference between varieties (V) but there was a very significant difference in interactions (varieties (V) × seed priming (P)) and seed priming (P). The best seed vigor was achieved by treatment V3P3 (1115.72) and smallest by V2p2 (740.87) (Table 4).

Table 2. *Means of Some Seed Germinations Parameters (Seedling Fresh Weight (mg), Seedling Shoot Fresh Weight (mg) Seedling Root Fresh Weight (mg) and Seedling Dry Weight (mg), under PEG Effect*

Treat.	SFW (mg)	SSFW (mg)	SRFW (mg)	SDW(mg)
V1P0	23.40	2.02	21.38	11.75^{ab}
V1P1	22.72	3.78	18.93	11.5^{ab}
V1P2	22.02	3.25	18.77	10.25^{bc}
V1P3	30.75	6.48	24.27	12^{ab}
V2P0	21.92	3.24	18.68	13.75^{a}
V2P1	25.93	4.29	21.64	10.5^{bc}
V2P2	27.11	4.48	22.63	12^{ab}
V2P3	31.72	6.43	25.29	12^{ab}
V3P0	16.96	3.70	13.26	8.75^{c}
V3P1	22.78	1.50	21.28	10.5^{bc}
V3P2	18.05	2.95	15.10	11.5^{ab}
V3P3	30.88	4.33	26.55	11.5^{ab}
SE±	2.92	0.71	2.56	0.72

Figures not sharing the same letters differ significantly at $p < 0.05$

Table 3. *Means of Some Seed Germinations Parameters Seedling Shoot Dry Weight (mg), Seedling Root Dry Weight (mg) and Shoot/Root Ratio under PEG Effect*

Treat	SSDW (mg)	SRDW (mg)	Shoot/Root Ratio
V1P0	1.25	10.5^{ab}	0.030
V1P1	1.5	10^{ab}	0.038
V1P2	3.75	7^{c}	0.116
V1P3	2.25	9.75^{abc}	0.058
V2P0	1.75	12^{a}	0.037
V2P1	2	8.5^{bc}	0.059
V2P2	4.25	7.75^{bc}	0.137
V2P3	2.5	9.5^{abc}	0.066
V3P0	1.75	7^{c}	0.063
V3P1	1.25	9.25^{abc}	0.034
V3P2	1.5	10^{ab}	0.038
V3P3	1.8	9.7^{abc}	0.046
SE±	0.63	0.89	0.19

Figures not sharing the same letters differ significantly at $p < 0.05$

3.2. Effect of PEG under Greenhouse Condition

3.2.1. Emergence Percentage (E %)

Results expressed the effect of PEG on Emergence Percentage (E %) of some aerobic rice cultivars under Greenhouse conditions reported that PEG had a very highly significant difference between varieties (V) but there was no significant difference between seed priming (P) and interaction (varieties (V) × seed priming (P). The highest Germination Percentage was obtained by the treatment V2P3 which was (93.33%) and the lowest by the treatment V1P0 which was (80%). (Table 5)

3.2.2. Germination Index (GI)

Differential influence of PEG on Germination Index (GI) of some aerobic rice cultivars, The Analysis indicated that the treatments of PEG had a very highly significant difference between varieties (V) but there was no significant difference between seed priming (P) and interaction (varieties (V) × seed priming (P). The maximum and minimum effect recorded by the treatments V3P3 and V1P0 which were (19.75) and (14.69) respectively (Table 5).

3.2.3. Days Of 50% Germinations (50%)

The investigation of the effect of PEG on 50% of some aerobic rice cultivars said that there was a very highly significant between varieties (V), interaction (V × P) and seed priming (P). Among treatments, the treatments (V3P1 and V3P3) reported the shortest germination time after 5 days and V1P1, V1P2 and V1P3 treatment was the longest one which was 7 days (Table 5).

Table 4. *Means of Some Seed Germinations Parameters (Seedling Length (cm), Seedling Shoot Length (cm), Seedling Root Length (cm) and Seed Vigor) affected by PEG .*

Treat	Seedling Length (cm)	Seedling Shoot Length (cm)	Seedling Root Length (cm)	Seed Vigor index
V1p0	9.88^{bc}	3.31^{c}	6.57^{abcd}	753.99^{d}
V1p1	12.19^{a}	4.84^{ab}	7.35^{abc}	1007.93^{ab}
V1p2	11.75^{ab}	4.7^{ab}	7.05^{abc}	993.11^{abc}
V1p3	10.03^{bc}	3.99^{bc}	6.04^{cd}	850.47^{bcd}
V2p0	13.46^{a}	5.39^{a}	8.08^{a}	1077.98^{a}
V2p1	12.94^{a}	5.27^{a}	7.68^{ab}	1097.63^{a}
V2p2	8.69^{c}	3.44^{c}	5.25^{de}	740.87^{d}
V2p3	11.99^{ab}	5.43^{a}	6.56^{abcd}	1025.88^{ab}
V3p0	11.88^{ab}	5.02^{ab}	6.86^{abc}	918.71^{abcd}
V3p1	11.75^{ab}	5.42^{a}	6.33^{bcd}	1012.54^{ab}
V3p2	9.14^{c}	4.69^{ab}	4.46^{e}	808.37^{cd}
V3p3	12.35^{a}	5.45^{a}	6.9^{abc}	1115.72^{a}
SE±	0.653	0.37	0.463	62.31

Figures not sharing the same letters differ significantly at $p < 0.05$

3.2.4. Means Germination Time(MGT):

The effect of different PEG management on (MGT) of some aerobic rice cultivars cleared which connected that there was no significant between varieties (V), seed priming (P) and even in interaction (V × P). MGT substantially highest for treatments V3P3 that about (1.67) compared with lowest one that was about (1.22) recorded by the treatment V3P0 (tables 5).

Table 5. *Means of Some Seed Germinations Parameters (Emergence Percentage, Germination Index (GI), Days Of 50% Germination and Means Germination Time (MGT)) under PEG effect*

Treatments	E%	(GI)	50%	(MGT)
V1p0	80	14.69	6.33^{bc}	1.24
V1p1	83.67	14.95	7^{b}	1.23
V1p2	84	15.01	7^{b}	1.23
V1p3	84.33	15.03	7^{b}	1.30
V2p0	89.67	16.93	5.67^{dc}	1.35
V2p1	92.33	17.24	5.67^{dc}	1.42
V2p2	92.67	17.52	8^{a}	1.35
V2p3	93.33	17.72	5.67^{dc}	1.51
V3p0	90	16.03	6^{c}	1.22
V3p1	87.67	19.64	5^{d}	1.66
V3p2	87.67	16.36	5.67^{dc}	1.66
V3p3	90.33	19.75	5^{d}	1.67
SE±	1.98	0.996	0.30	0.21

Figures not sharing the same letters differ significantly at p< 0.05

3.2.5. Seedling, Shoot and Root Fresh Weight (mg)

Statistical Analysis of Data appeared the influence of different PEG concentrations on Seedling Fresh Weight (SFW) (mg) of some aerobic rice cultivars. PEG had no significant between varieties (V) and between interactions (varieties (V) × seed priming (P) but there was a significant difference between seed priming (P) and Seedling Fresh Weight (mg) was highest value by the treatment V1P3 about (87.39 mg) and lowest value obtained at treatment V3P0 about (49.32 mg) (table 6). An explanation of the important of different levels of PEG on Seedling Shoot Fresh Weight (SSFW) (mg) of some aerobic rice cultivars lighted that there was no significant difference between varieties (V), interactions (varieties (V) × seed priming (P) and seed priming (P). Seedling shoot Fresh Weight (mg) was highest value by the treatment V1P3 about (48.67 mg) and lowest value obtained at treatment V3P0 about (20.11 mg) (table 6). The output of Seedling Root Fresh Weight (SRFW) (mg) of some aerobic rice cultivars under PEG affected fingered and indicated that there was no significant difference between varieties (V), very , seed priming (P) and Interactions (varieties (V) × seed priming (P). Largest number of Seedling Root Fresh Weight (mg) had found that recorded by the treatment V2P3 that about (40.76) and (23.03 mg) the narrowed one by the treatment V1P0 (Table 6).

3.2.6. Seedling, Shoot and Root Dry Weight (mg):

Some aerobic rice cultivars seed under PEG Priming condition and its reflected on Seedling Dry Weight (SDW) (mg) Noticed that there was no significant difference between varieties (V), seed priming (P) and interactions (varieties (V) × seed priming (P).The heaviest Seedling Dry Weight (mg) written by treatments V1P3 that about (34 mg) and lightest by V3P0 about (26 mg) with range about 8mg between them (Table 6). Results regarding Seedling Shoot Dry Weight(SSDW) (mg) told us about the effect of PEG of some aerobic rice cultivars under field condition the result had no significant difference between varieties (V), seed priming (P) and significant difference between interaction (varieties (V) × seed priming (P).The Oldest Seedling Shoot Dry Weight (mg) was obtained by the treatment V1p3 which was (18.67 mg) and the youngest by the treatment V3P0 which was (11 mg) (Table 6). Analysis of the influence of PEG on Seedling Root Dry Weight (SRDW) (mg) of some aerobic rice cultivars, The Analysis indicated that there was no significant difference between varieties (V), seed priming (P) and between interactions (varieties (V) × seed priming (P). The Greatest effect recorded by the treatments V1P1, V2P2 and V2P3 which were (16 mg) and lowest V2P0 (16.5 mg) (Table 6).

3.2.7. Shoot/Root Ratio:

Statistical Analysis of provided the effect of PEG on Shoot/Root Ratio of some aerobic rice cultivars. The results said that there was no significant between varieties (V), seed priming (P) and interaction (V × P). Between treatments, the treatment V1P2 reported the highest value Shoot/Root Ratio (1.37) and V1P1 treatment was the lowest one which was (0.76) (Table 6).

3.2.8. Seedling, Shoot and Root Length (cm):

Management of The effect of different PEG on Seedling Length (cm) of some aerobic rice cultivars finally conclusions that there was a significant difference between varieties (V), but there was no significant difference among seed priming (P) and interaction (V × P). Seedling Length (cm) substantially longest for treatments V1p3 that about (17.39 cm) compared with shortest one that was about (11.61 cm) recorded by the treatment V2P0 (Table 7). Data Statistical Analysis observed the influence of different PEG concentrations on Seedling Shoot Length (cm) of some aerobic rice cultivars. PEG had a very highly significant difference between varieties (V) and no significant difference between seed priming (P) and interactions (varieties (V) × seed priming (P). Seedling Shoot Length (cm) was Longest value by the treatment V1P2 about (8.68 cm) and shortest value obtained at treatment V2P0 about (6.2 cm) (Table 7). Calculate the important of different levels of PEG on Seedling Root Length (cm) of some aerobic rice cultivars. The data analysis lighted that there was no significant difference between varieties (V), interactions (varieties (V) × seed priming (P)) and seed priming (P). Seedling Root Length (cm) was highest value by the treatment V1P3 about (9.52 cm) and lowest value obtained at treatment V3P1 about (6.33 cm) (Table 7).

Table (6) *Shown the Means of Some Seed Germinations Parameters (Seedling Fresh Weight (mg), Seedling Shoot Fresh Weight (mg) Seedling Root Fresh Weight (mg), Seedling Dry Weight (mg), Seedling Shoot Dry Weight (mg), Seedling Root Dry Weight (mg) and Shoot/Root Ratio) under PEG Effect*

Treat.	SFW (mg)	SSFW (mg)	SRFW (mg)	SDW (mg)	SSDW (mg)	SRDW (mg)	Shoot/ Root Ratio
V1P0	58.07	35.03	23.03	29.33	13.67	15.67	0.9
V1P1	55.18	23.92	31.25	28	12	16	0.76
V1P2	72.82	42.3	30.52	31.33	18	13.33	1.37
V1P3	87.39	48.67	38.72	34	18.67	15.33	1.27
V2P0	57.42	23.70	33.72	27.33	14.67	12.67	1.35
V2P1	72.80	39.63	33.17	30.67	16.67	14	1.20
V2P2	66.36	31.01	35.35	30	14	16	0.88
V2P3	74.76	34	40.76	29.33	13.33	16	0.84
V3P0	49.32	20.11	29.21	26	11	14	0.83
V3P1	68.47	29.34	39.14	26.67	13.33	13.33	1.17
V3P2	50.00	24.98	25.02	29.33	14.67	14.67	1.02
V3P3	72.67	33.44	39.22	29.33	14.67	14.67	1.04
SE±	8.69	6.7	6.99	2.46	1.87	1.93	0.22

Figures not sharing the same letters differ significantly at p< 0.05

3.2.9. Seed Vigor:

Used PEG as Priming agent of some aerobic rice cultivars seed and it's expressed on Seed Vigor Assessed and announced that there was no significant difference between varieties (V), interactions (varieties (V) × seed priming (P)) and seed priming (P). Strongest Seed Vigor had written by treatments V1P3 about (1474.73) and weakest by V2P0 about (1041.2) with (Table 7).

Table (7) *Shown the Means of Some Seed Germinations Parameters (Seedling Length (cm), Seedling Shoot Length (cm), Seedling Root Length (cm) and Seed Vigor)) under PEG Effect*

Treat	Seedling Length (cm)	Seedling Shoot Length (cm)	Seedling Root Length (cm)	Seed Vigor
V1p0	14.67	7.57	7.1	1173.33
V1p1	14.37	7.49	6.88	1206.4
V1p2	15.61	8.68	6.93	1310.57
V1p3	17.39	7.87	9.52	1474.73
V2p0	11.61	6.2	5.41	1041.2
V2p1	15.99	7.85	8.14	1473.55
V2p2	12.51	5.95	6.55	1159.63
V2p3	14.19	6.87	7.31	1322.87
V3p0	14.03	6.93	7.09	1262.14
V3p1	13.82	7.49	6.33	1214.53
V3p2	14.87	7.55	7.32	1306.39
V3p3	14.92	7.56	7.36	1346.41
SE±	1.01	0.41	0.77	99.99

Figures not sharing the same letters differ significantly at p< 0.05

Our result indicated that seed priming is a best practice for improving seed germination behaviors. These finding are supported by earlier work on improved germination by using PEG in cereal crops (Basra et al., 2002; Mehdi et al., 2008; Muhammad et al., 2014) significant effect of PEG on germination aspect may be due to increased rate of cell division in the seed as previously found for rice (Bose and Mishra, 1992; Mehdi et al., 2008; Muhammad, 2014) in addition to increase in emergence with priming might be due to initiating metabolic event in primed seed. The result from the greenhouse confirms the generally beneficial results of PEG on number of crop parameters. Basra et al. (2003) and Arif et al. (2008) have reported improved germination and emergence established in field trials of PEG primed seed. Improvement in later growth have been noted in sorghum (Sorghum bicolor) and ryegrass (Lolium multiflorum) using PEG (Hur, 1991; Muhammad et al., 2014). Many other reports have also shown the beneficial effect of priming on improved and earlier seedling emergence of many beans and cereals (Harris et al., 2001; Musa et al., 2001; Murungu et al., 2004a. 2004b; Arif et al., 2005; Rashid et al., 2006; Shah et al., 2012; Muhammad et al., 2014).The improved establishment in primed seed might be due to the completion of pre-germinative metabolic activities which makes the seed ready for radicale protrusion so that the seed germinates soon after planting compared with untreated dry seed. It may also be due to metabolic repairs processes, a buildup of metabolites or osmotic adjustment during priming (Bray et al., 1989) or improved membrane integrity and enhance physiological activities at germination (Sung and Chang, 1993 and Muhammad et al., 2014) But insignificant effect of PEG may be due to reduced oxygen when treated seed with PEG solution according to Young and Evans (1976) theorized that reduced oxygen availability in the PEG stratification solution might have accounted for detrimental effects on seed germination behaviors. This confirmed by Mexal et al. (1975) found reduced oxygen solubility in solutions of PEG 4000, 6000 and 8000 by nearly 20%. Availability of oxygen is thought to be important in the maintenance of metabolic functions necessary for dormancy release and prevention of secondary dormancy induced by oxygen deficiency (Hartmann and Kester 1990, Murdock and Ellis 1992).

Conclusion:

Soaking rice seed in the PEG solution 200gL^{-1} until priming indicator will lead to accelerated and improved Germination behaviors on the form of Germination Percentage, Germination Index (GI), Days Of 50% Germination, Seedling Fresh Weight (mg), Seedling Shoot Fresh Weight(mg), Root Fresh Weight (mg), Seedling Dry Weigh (mg), Seedling Shoot Dry Weight(mg), Root Dry Weight (mg), Shoot/Root Ratio, Seedling Length (cm), Seedling Root Length (cm), Shoot Length (cm) and Seed Vigor index under laboratory and greenhouse condition .

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