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Research Article

The Effect of the Quantity and Quality of Water on the Weight and Rates of Germination of *OryzaSativa* of the Family *Gramineae* in Iraq

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ABSTRACT
The experiment was conducted in Kufa district Najaf Province fromthe periodof (1/8/2015)to(13/8/2015) to find out the effect of water amount used for seeds irrigation (50,100,150 ml water / kg soil).And water quality(drang water 2900 Micro Siemens \ cm, river water 673 EC) Micro Siemens \ cm), tap water (EC 627 Micro Siemens \ cm) on seed weight and germination percentage *Oryzasativa* L.by taking Sample between other day from sowing till 13thday Results showed that there were an increase in seed weightwith irrigation with 150 ml/kg soil and tap water it reach the percentage of %311.1 ،173.3% ,respectively.Germination percentage also increase to reach 100% at the 6th dayfrom sowing with treatment 1 Mean while germination percentage of 100%was appear in the8th day but with aquality of water of 100 ml/kg Soil .This situation continued until the end of experiment after13 th day of Sowing Nevertheless ,Seed weight was different at the end of the experiment at the above two treatment whilel, germination Percentage 100% after passing 13 day for tap Water treatment.

Keywords: *OryzaSativa*, Family *Gramineae*, Quality of Water.

INTRODUCTION

The type of rice (Anber) belongs to the same genus as *Oryza sativa* L.of the familyGrameenae, which includes about 600 species,including5000 species or more In Iraq, about 250 wild and 35 species are cultured for economic purposes. These species have an economic importance that exceeds all other families of humans[1]. This wild family is represented inIraq with about 101 genera and 270 species[2]. Rice in Iraq is the most important meal in the kitchen and comes second after wheat. For these reasons, the effect of water quantity and quality in the weight and germination rate of seeds of these plants was studied. Germination is an essential stage in the life cycle of plants in general and developing plants in the salinatedsoil in particular. Therefore, the viable seed germination and seedling formation in saline soil is one of the specific cultivation factorsof plants in those soils[3,1]. Water is a key environmental factor for germination. The enzymatic activity and the destruction and construction of different foodstuff require water to complete. As is well known, seed germination is mainly controlled by its water content. When cultivating dry seeds, the water absorbs quickly at first until saturation and bloating, followed by a decrease in the water absorption rate, which is keeps increasing by the appearance of the wall and the rupture of the seed shell. The seedabsorptivityfor water depends on several important factors, including the permeability of the seed covers to the water and the available water in the medium surrounding the seed penetrability for water, water availability around the seed, the temperature of the environment or medium, as well as the effect of surrounding climatic conditions. By germination of the seed and the formation of the root of the seed, it begins to rely on the root mass and its ability to form other small root hairs that contribute to the absorption of water from the surrounding medium and the amount of water absorbed by the seed during the period of bloating until the appearance of the root is considered important factors as it can affect both the proportion and rate of germination of seeds as germination passes through several stages:

A- Water absorption stage
B- Food digestion stage
C- Development stage

Previous studies in this field have shown that increased levels of salinity reduce the proportion of seeds growing and prolong the duration of germination as in wheat[4], and maize[5]. Studies have shown that a decrease in the percentage of germination effect of salinity differs according to plant species[6]. Water also has an important function in the process of germination, as it is important in the process of overcoming the effect of inhibitory materials. Soil, as noticed by researchers, has a negative effect on plant growth through its effect on dry weight, thus[7]. Found out that moisture levels led to a decrease in the dry weight of wheat[8] noticed that the increase in the soil moisture level to the level of field capacity led to an increase in the dry weight of rice. The decrease in dry material in irrigation shortage was attributed to decreased carbohydrates because of limitation of photosynthesis and

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Table 1: Effect of water quantity and quality on the weight of seeds in Iraq.

Water quantity rate	Time rate	Water quality			Duration (day)	Water quality
		tap	River	drainage		
		0.240	0.230	0.200	1	
0.281	0.256	0.273	0.260	0.250	3	50
		0.407	0.380	0.287	6	
		0.280	0.273	0.243	1	
0.338	0.319	0.330	0.317	0.270	3	100
		0.473	0.473	0.380	6	
		0.300	0.270	0.267	1	
0.499	0.542	0.480	0.403	0.290	2	150
		0.933	0.880	0.663	6	
		0.413	0.387	0.317	Water quality rate	

L.S.D. 0.05 Time= 135.0, water quantity= 0.1350, water quality= 0.1350, interference= 0.395

food uptake from composition to storage. Other reasons include shortage of water increases absorbing nutrients from water such as phosphorus, nitrogen, calcium, potassium and magnesium, which are involved in the formation of cellular membranes and the formation of protein, DNA and RNA to reduce the formation of plant biomass and reduce the accumulation of dry matter[7].

MATERIALS AND METHODS

The soil was brought from the technical institute (from the Euphrates River) - Najaf governorate. It was placed in non - perforated plastic base with diameter (18 cm) and depth (16 cm). Capacity: 2 kg of soil. Water samples from one of the areas of Al - Mawash area in the Abbassiya region, where the EC was (2900 micro Siemens / cm), and samples of river water were collected from the Euphrates River in the same area, where the EC (673 Micro Siemens / CM). The water samples of the faucet originated from a water project in Al-Hira area, in which the EC was (627 Siemens / cm). Oryza sativa (rice) seeds were used, (Anber) category (33), from local markets. The experiment was conducted in the Abbasid area of Najaf Governorate and from the year 2015 till the end of the year (8/13/15) to reveal the importance of the effect of water quantity and quality in the germination rates of the seeds of the plant and weight of (10) seeds (0.18 g). Two (kg) soil was put in each pot to prepare for seeding with (60) seeds in each pot, which consisted of 27 pots per each type of rice plant, after weighing the seeds, taking into account the removal of damaged seeds and abnormalseeds and selection of all types of equal sizes as far as possible.

The irrigation process was done directly after germination and the treatments (50,100,150 ml water / kg soil) with the three types of water used in the irrigation process and three replicates for each treatment. The irrigation process was every other day successively with the sampling process.

Design of Experiment

Parameters of the experiment was distributed inRandomized Complete Design with two factors:

The quantity of irrigation water in three levels and three replicates.

The quality of irrigation water in three levels and three replicates.

Indicators studied

The objective of the experiment was to determine the rate of seed weight at which the germination of the plant species and the quantities and quality of the three water amounts begins which differ in terms of salinity in the germination ratio. Therefore, the following indicators were calculated.

Average of seed weight

In this case, the seeds were weighed every otherday at the beginning of seedingby removing ten seeds from each pot (repeated) for each plant type, each type of water and its weight by a sensitive scale.

Calculating the number of seeds grown in every other day of the ten seeds that were weighed in order to extract germination percentage for each replicate in each treatment and each plant type in each water type according to the following equation:

$$Germination\ rate\ (\%) = \frac{No.of\ seeds\ grown}{No.of\ sample\ seeds} x100$$

Thus calculate the increase in seed weight and its impact on germination ratio can be calculated, by comparing the weight rates of seeds with their counterparts'weights before the starting seeding and irrigation process for each plant type for each treatment of the type and quantity of water. The pots were weighed to calculate the moisturized weight percentage which is 31.5% of the soil weight which reached 0.96 kg / water or equal to 0.63 liters which is equal to the quantity of the soil or 150% of the water of. This amount was then transferred to 100% and 50% after multiplying the water quantity by Which reached 0.63 liters and 0.32 liters of water.

RESULTS

Table (1) shows that the quality of irrigation water has a significant effect on the weight of rice seeds. The irrigated seeds of rice (EC 627 micro Siemens / cm) yielded a higher weight of 4 0 g, compared to the lowest weight of seeds irrigated with drainage ECS (2900 microSD / CM).

On the other hand, the same table showed that the duration of sample collecting had significant effect; the sample taken for six days gave weight to rice seeds of 0.933 g, compared with the sample taken after one day of germination of 0.200 g. The water quantity factor also

Table 2: Effect of water quantity and quality on the percentage of seed germination in Iraq

Water quantity rate	Time rate	Water quality			Duration (day)	Water quality
		tap	River	drainage		
		0.00	0.00	0.00	1	
10.89	9.41	0.00	20.00	0.00	2	50
		20.00	55.00	3.00	3	
		0.00	0.00	0.00	1	
42.78	50.00	60.00	50.00	20.00	3	100
		100.00	100.00	55.00	6	
		38.00	29.00	17.67	1	
76.07	70.33	100.00	100.00	100.00	3	150
		100.00	100.00	100.00	6	
		46.44	50.44	32.85	Water quality rate	

L.S.D. 0.05 Time= 9.524, water quantity= 9.524, water quality= 9.524, interference= 15.242

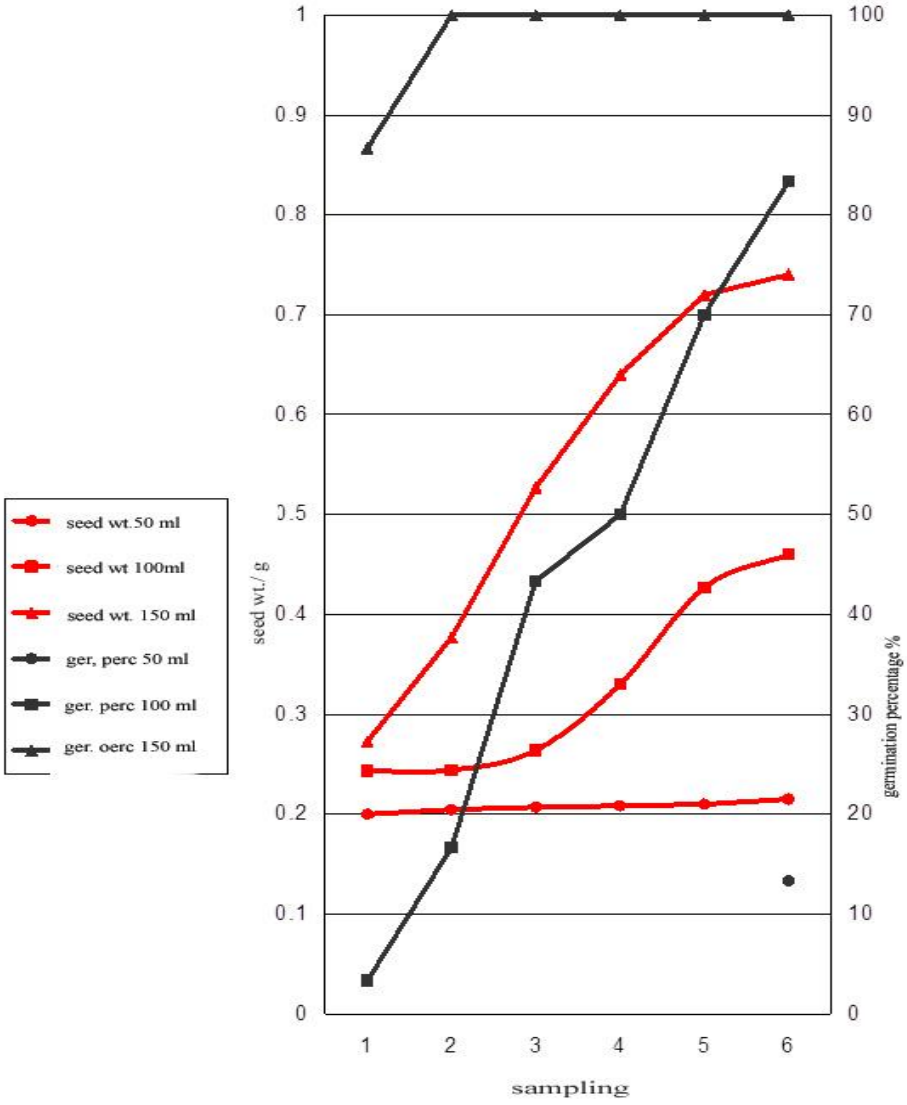

Figure 1: effect of water quantity on seed weight and germination percentage of rice seed.

had a significant effect on the weight of rice seeds. The water amount of 150 ml yielded heavier seeds of0.933 gm compared with 50 ml which yielded 0.200 gm. As for the triple interference for the experiment factors, the results of the same table showed that the irrigation tap water 150 ml exceeded forsix days with a significant effect, with a highest weight of 0.933 g, compared to the lowest weight of 0,200 g, resulted from the amount of drainage water 50 m for a day after germination.

Table 2 shows that the quality of irrigation water has a significant effect on the percentage of germination of rice seeds. The percentage of germination of irrigated rice

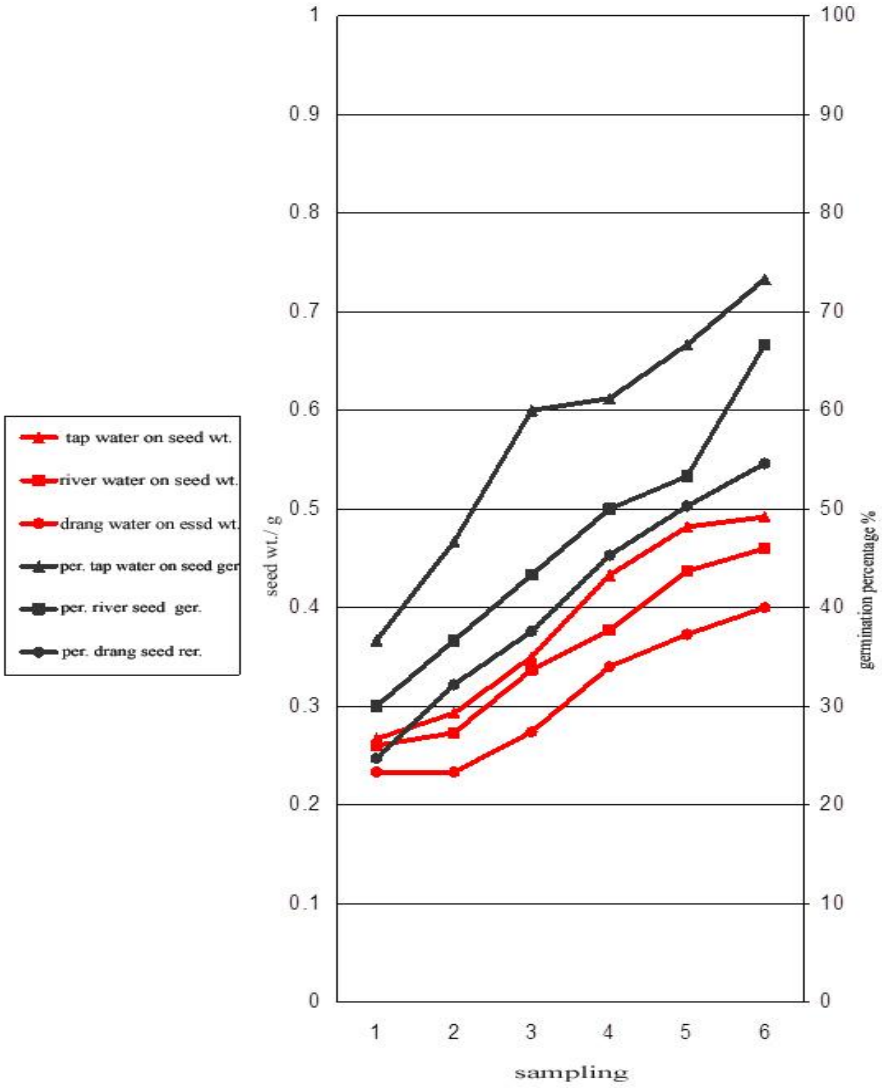

Figure 2: effect of water quality on seed weight and germination percentage of rice seed.

with tap water has produced the highest percentage of 100% compared to the lowest germination percentage of drainage irrigated seeds 00.00%. The results of the same table showed that the duration of sample collecting had significant effect, as the sample taken for six days gave 100% for rice seeds compared to the sample taken a day after germination of 00.00%. The water content factor also had a significant effect on seed rate. The 150 ml amount of water produced the highest percentage of germinating seeds as 100%, compared to 50 ml, producing % 3.00.

As for the triple interference of the experiment factors, the results of the same table showed that the tap water content of 100 and 150 ml for a period of three and six days had a significant effect, with the highest percentage of 100%, compared to the lowest of 3.00% from 50 ml of drainage irrigation water a day after germination.

Figure (1) shows the effect of the amount of water on the weight and percentage of germination of rice seeds. It was found that the weight of (10) seeds of the plant mentioned before the seeding process is (0.18 g). In the first treatment, in which a water quantity of (50 ml)water / kg of soil) every other day, the average weight for every(10) seeds reached the day of the first sample (taken after three days of the seeding) is (0.2 g) and the weight continued to increase until the weight of each (10) seeds on the day of the sixth sample (taken after 13 days of the seeding) is (0.215 g) thus increasing the weight by (19.44%).The germination percentage is (13%), which is the first day of germination.

The second treatment (in which 100 mL water / kg of soil was added) showed that the weight of (10) seeds on the first sampling day is (0.242 g) and the weight increased by (34.44%). The germination rate was then (3%) which continued to increase for the weight and germination rate; the weight rate for each (10) seeds in the sixth sample reached (0.46 g). Thus, the weight increased by (155.55%) and germination rate was (83%).

In the third treatment, the weight on the day of the first sampling reached (0.273 g), thus increasing the weight by

Table 3: Differences in increments of weight and germination rates with different rice seeds and stability of other factors after 3 days of seeding.

Germination rate	Weight increase rate (%) compared to original	Plant species
24	36.67	rice

Table 4: The difference in weight and germination rates with different seeds and the stability of other factors after (13 days) of seeding.

Germination rate	Weight increase rate (%) compared to original	Plant species
65.2	156.2	rice

Table 5: Effect of irrigation water quantity on increment of weight and germination rates with stabilizedother factors after (3 days) of seed.

Germination rate (%)	Increase rate (%) compared to original	Irrigation water quantity (ml water/kg soil)
5.5	25.6	50
40	79.6	100
80	155.6	150

Table 6: the effect of the amount of irrigation water on increasing the weight and germination rates with the stability of the other factors (13days) after seeding.

Germination rate (%)	Increase rate (%) compared to original	Irrigation water quantity (ml water/kg soil)
41.1	56.3	50
94.4	244.6	100
100	435.8	150

(51.67%). The germination rate in this sample was (86%). On the day of taking the second sample (taken five days afterseeding), the increment increased in weight and germination reaching (100%) in which the weight of each (10 seeds) is (0.377 g). Thus, the weight increased by (109.44%). The weight continued to increase until the sixth sample with (0.74 g) and germination rate (100%) as well.

Figure (2) shows the effect of water quality on the weight and percentage of seed germination. In the first treatment, in which water was irrigated with drainagewater every other day, the weight of (10) seeds (in the first sample) taken three days after the seeding is (0.233 g), with the weight of each (10 seeds) as (0.18 g). The weight increased by (29.44%) and the germination rate was (25%). The weight increase in the sixth sample (taken after 13 days of the seeding process) was (0.4 g). Thus, the weight increased by (122.22%). The germination rate in this sample was (55%).

The second treatment, in which irrigation was done with river water, showed that the weight per (10) seeds in the first sample was (0.26 g). Thus, the weight increased by (44.44%). The germination rate in this sample was (30%) and germination rates kept increasing until the weight of each (10 seeds) in the sixth sample became (0.46 g), thus increasing the weight by (155.55%) and germination rate was (66%).

The third treatment, in which the irrigation was done with tap water, showed that the average weight per (10) seeds in the first sample was (0.267 g). Thus, the weight increased by (48.33%) and the germination rate in this sample was (37%). Weight and germination rate continued to increase. The weight in the sixth sample reached (0.492 g); the weight increased by (173.33%) and the germination rate in this sample (73%).

DISCUSSION

The results of Tables 1 and 2 show a decrease in the weight and percentage of seeds irrigated with 50 ml drainage water, due to the absence of some external factors that are necessary for germination inhibiting seed germination such as water, temperature, oxygen, light, ventilation, and salinity increase[10]. The results of the study showed variant effect of water on the germination process of the rice seeds due to the genetic nature of the plant seeds. The delay in germination and the decrease in its percentage by increasing the salinity levels is due to the increase in salt concentration, which increases the osmosis stress of the soil water leading to inhibiting water penetration to the seeds which in turn hampers the chemical reactions necessary to expedite germination[3,11]. Moreover, increasing salinity concentration and accumulation in the seed may have a toxic effect inhibiting the action of enzymes Because growth is affected by several factors, including natural conditions of soil, climate and water, where the inappropriate condition of any of them leads to a decline in growth indicators of the other, as the above results indicate[10]. Figures[1,2] also showed the effect of salts in the weight ratios for each[10] seeds. The seeds of rice plant decreased in weight and with the high salinity of irrigation water. The treatment of drainage water showed lower rates of weight compared to the treatment of river and faucet water, whose results were approximate in the first four samples and showed differences after that, ie, the fifth and sixth samples. Therefore, the high salinity rates have a significant negative effect on weight. Salinity absorption leads to the change of enzymatic activities leading to the continuation of the chemical reactions that affect the growth by inhibiting the work of building enzymes, especially the enzymes of proteins, carbohydrates, and dextrose enzymes[12,13]. Water amount has a fixed relation with seed weight during germination and germination rate. Increasing the quantity of water given during the germination period, increases the germination rate, which is affected by the increase of the amount of water into the seed, which was found by in two types of barley and[14], in his study on five varieties of wheat and[15] in his study on three varieties of wheat. The effect of sodium chloride may be osmotic, or due to the toxicity of ions or both[4]. On the contrary, the appropriate natural growth factors lead to increased weight and rate

of seeds, as shown in Tables 2.1. It is concluded from this experiment that:

The amount of water has a strong relationship with both seed weight during germination and germination rate. When increasing the amount of water processed during the germination period, the germination rate increases due to the increase of the amount of water penetrating into the seed. This depends on the speed and amount of water flowing into the seed which may be affected by type of (Salts), which caused a delay in germination and seed weight during germination.

Several studies have shown the effect of water on germination as well as its effect on growth. The results in Figures (1,2) showed that the amount of water given to the plant varied in effect on germination rates, showing a difference in seed germination ratio (Figure 1). The differences were evident in the treatments (150,100,50 ml water / kg soil) While the seeds of rice plant were affected (Figure 2).

From the above results, we can illustrate the difference in seed response in Tables 4 and 3 due to the genetic nature of each plant.

As shown in Figs. (1,2), the effect of the water quantity on the weight of (10) seeds was also shown. In the seeds of the rice, it was found that the amount of water in the treatments (150,100,50 ml / kg soil) did not show any obvious differences in the first sample. But in the samples that followed the first sample, the differences were clear, especially in the last sample where the effect of water quantity was clear. The treatment (150 ml / kg soil) gave the highest weight, followed by the treatment (100 ml water / kg soil) Water / kg soil), and (50 ml water / kg soil). The weight of treatment (50 ml water / kg soil) increased slightly through the end, while in the treatment (100 ml water / kg soil) rise in the first three samples was unclear but in the last three samples it was clear while the increase in treatment (150 ml / kg soil) was evident from the first sample through the sixth sample.

Table (5) shows the effect of the amount of irrigation water on the rise in weight and germination rates, with the stability of other factors after 3 days of seeding, and the effect of irrigation water on increasing weight and germination rates, 13 days after seeding.

The decrease in the weight of 10 seeds when the amount of irrigation is reduced may be due tothe slow process of absorption in the seeds[16,17].

The effect of the quality of irrigation water (drainage water, river water, tap water) on the weight and germination rates was shown in (Fig. 2). There are differences in rice seeds between the three treatments due to high salt concentration leading to osmosis stress for the water of soil leading to reduced penetration of water into the seeds which in turn hamper chemical reactions which stops germination. Also, the high concentration and accumulation of salt in the seed has a toxic effect inhibiting the action of enzymes, thus impeding the entry of waterinto the seeds and hinder seed germination by affecting the vital acts in the fetus associated with the process of germination, Fig. (2.1) also indicated that the salinity has an effect on the weight of each (10 seeds). A weight decrease was found in the seeds of the rice plant with high salinity of irrigation water. The treatment of the drainage water showed less weight compared to the treatments of river and faucet water, whose results were approximate in the first four samples and showed differences afterwards, therefore, the high rates of salinity significantly negative impact on weight.

It is concluded from this experiment that: - The amount of water has a strong relationship with the weight of seeds during germination and germination rate, when increasing the amount of drainage irrigation water given during the period of germination increases the rate of germination affected by the increase in water quantity and quality as indicated by[15] in his studyof three varieties of wheat. The effect of sodium chloride may be osmotic or due to the toxicity of ions or both[4]. On the contrary, the appropriate natural growth factors lead to increased seed weight and rates, as shown in Tables 2.1. It is included from this experiment that:

The amount of water has a strong relationship with both seed weight during germination and germination rate. When increasing the amount of water available during the germination period, it increases the germination rate due to the increase of the amount of water into the seed. This depends on the speed and amount of water flowing into the seed which might be affected by the quality of water (salts), which caused a delay in germination and seed weight during germination.

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