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Effects of the Biochemical Organic Fertilizer of Rice Husk Plus Wood Waste on Germination and Growth of Rice and Lentil Seeds to Prove its Non-toxicity

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ABSTRACT: Non-toxicity *is one of the quality characteristics of organic fertilizer, and a simple method to evaluate the non-toxicity of compost is to check the germination of seeds in the wastewater obtained from soaking of organic fertilizer in distilled water compared to the germination of seeds in pure distilled water. This study aimed to estimate the non-toxicity of biochemical fertilizers produced from rice husks plus wood waste and its effects on germination and growth variables in pot culture on the germination of rice and lentil seeds. The cultivation experiment was conducted in an enclosed room. In the examination of germination, the ratio of lentil germination in the wastewater obtained from* soaking *organic fertilizer in distilled water compared to pure distilled water was 83.3% and 97% after one and seven days, respectively. For rice seeds, this factor reached 98.5% after seven days, and all these results indicate the non-toxicity of the treatment environments resulting from the wastewater separated from the organic fertilizer soaked into distilled water. Next, the results of the second stage experiments showed that rice and lentil seeds in the sandy soil environment with the organic fertilizer have a significant positive effect on the germination and growth of the sprouts, both in terms of germination and growth rate. Similarly, other properties such as increased growth, root, and stem length, the number of leaves, the number of roots, the wet and dry weight of 10 plants, and also the effectiveness of the fertilizer in preventing the spoilage of plants in the cultivation environments containing percentages of rice husk plus wood waste fertilizer were higher than the sandy soil without fertilizer. These results indicate that the discussed biochemical organic fertilizer obtained from rice husks with wood waste has a desirable non-toxic quality for rice and lentil germination and growth.*

KEYWORDS: *Biochemical fertilizer; Biochemical process; Rice husk; Seed germination.*

INTRODUCTION

Agricultural by-products are abundant in the world as carbon and energy bio-resources (25-37% of all agricultural products), and most of them are destroyed by themselves in the fields (rotted and decomposed). Therefore, proper management and proper use of these wastes will be welcome news and promising subjects. Rice husk is one of these organic wastes produced frequently in rice mills and is widely available. On the one hand, as a renewable resource, these wastes are effective on the C: N ratio of the soil and the life of soil organisms. On the other hand, burning them in rice mills or farms results in the emission of greenhouse gases [1]. Degradation and biological transformation of agricultural waste into compost (organic fertilizer) and its combination with soil help the cycle of nutrients in it and its fertility [2]. Therefore, one of the appropriate solutions for using rice husks may be to compost them. There is a large number of lignocellulolytic bacteria and fungi being used to produce compost from agricultural residues and other lignocellulosic residues[3]. They are filamentous fungi that can produce intense (abundant) spores and quickly attack substrates. Fungal cultures, as one of the residues of rice fields, have been used to compost rice stalks[3]. Composts act as an excellent source of nutrients in organic (non-chemical) agriculture and reduce the problems caused by chemical fertilizers. Therefore, there is a tendency to reuse these materials in green technologies and various applications such as compost or organic fertilizer and other biotechnological processes[4]. Co-composting strategies using biological agents (fungal and bacterial) were developed to improve the quality of compost products [5], and this subject was adopted in this study. These processes reduce the size of the particles, increase the specific surfaces, and create several functional groups on the surface of the compost product so that it can be used in the plant culturing environment[6]. The growing medium of a plant serves as the material in which the plant's roots grow, and water and nutrients are absorbed[7]. The growing medium is a mixture of compounds that provide water, air, and nutrients and support the growth and resistance of plants against wind and rain et. [8]. Using an organic culture medium for plants has some advantages as they are natural resources, cheaper than mineral materials, and provide various nutrients for plants [9]. Organic fertilizers (composts) are used for seed cultivation, agriculture, growing plants and vegetables, producing organic products, improving the environment, and removing pollutants. Therefore, it is essential to estimate the quality and non-toxicity of organic fertilizers. The seed germination test is a powerful method for testing the toxicity of organic fertilizer (produced through composting processes), which is one of the most crucial aspects of compost and organic fertilizer product quality. The prerequisite for successful production of organic agricultural products is strong and healthy germination over time[10]. Compost quality, including stability and maturity, should be evaluated before use in the field. Unstable or unripe compost can affect germination, plant growth, and the soil environment by reducing the availability of absorbable oxygen or nitrogen or the presence of phytotoxic compounds[11]. Stability is the resistance of organic materials against further biochemical degradation, and it does not have inhibitory effects on microbes through other variables unrelated to organic materials. Maturity is a parameter related to land exploitation (agronomics), which is dependent on the effect of compost on plant growth[12]. The indicators of respiration and soil plant formation (humification) of the compost are used to determine the stability and maturity of the compost, respectively[13]. Respiration and soil plant formation (humification) indices of the compost are used to determine the stability and maturity of the compost, respectively. Some substrates such as organic acids with small molecules (such as phenolic acids)[14], ammonium nitrogen (NH+4-N)[15], salinity[16], heavy metals[17], xenobiotics (such as antibiotics[18], and agricultural chemistry[19] can cause damage to plants at higher levels. It is usually necessary to measure many of these substances regarding the time of consumption, but processes of tracking whether the above is within the acceptable range are costly. However, some methods estimate the presence and scope of the above cases without performing any analyses. In addition, there are still no guidelines for analyzing and estimating the toxicity effects of materials in compost. As a result, as a bioassay, the seed germination test (SG) has attracted plenty of attention to investigate these factors. Zucconi et al. proposed the seed germination index (GI) in 1981 for the first time, where cress seeds were used in a germination test to determine toxicity[20]. GI was calculated using root length, and the germination percentage of seeds in the sample (compost extract) was compared with control samples (e.g., distilled water). GI was associated with other biological and chemical indicators to determine compost quality. GI was associated with other biological and chemical indicators to determine compost quality. Therefore, using biochemical organic fertilizer obtained from rice husk with wood waste in the pot can be considered one of the effective techniques for the growth and increase of sprouts in an organic production system. Such organic fertilizers, which contain high levels of nutrients and organic matter, can be an effective alternative to chemical fertilizers[21]. Farmers occasionally face problems with increased sprout growth over time due to environmental factors such as storms. This technique has the necessary potential to be implemented in every condition because, in unfavorable conditions, the pots are moved to a safe place to facilitate the production of seed sprouts over time. In this study, we focused on estimating the toxicity of biochemical fertilizers produced from rice husks and wood waste and their effects on growth variables in pot culture and the germination of rice and lentil seeds.

EXPERIMENTAL SECTION

Materials

First, organic fertilizer was produced through the biochemical composting process from rice husks with wood waste as compostable materials and corn steep liquor (CSL) and sugarcane molasses as nutrient additives. Rice husk and wood scraps were received from a rice factory in Foeman, Guilan-Iran, and Chouka Wood and Paper Factory in Guilan-Iran, respectively. Additives for starch production from corn and sugarcane molasses were also obtained from Glucozan Company in Qazvin and Haft Tape Company in Khuzestan Ahvaz-Iran, respectively. The biochemical organic fertilizer was produced based on the Platelet-Berman experiment, and its influencing variables were identified[22]. Based on the Central composite design experiments (CCD), the influencing variables in the composting process were optimized (data not shown). The study aims to investigate the effect of organic fertilizer produced from rice husks with wood waste and nutrients mentioned above, additives on seed germination and plant growth, and to estimate the toxicity of this fertilizer. For this purpose, two samples of rice and lentil seeds were selected. Local Hashemi rice and lentil seeds were obtained in Talesh city, Guilan, Iran. The chemical characteristics of the produced fertilizer examined in germination are shown below:

> Initial pH of 6.5±0.5, EC of 2.1±0.1μS/cm, TOC of 35±2%, total nitrogen of1.7±0.2%, C: N ratio of 20.7±1.3, K^+ of 1.2±0.2%, Ca^{2+} of 0.9±0.2%, Mg^{2+} of 0.8±0.2%, Fe^{2+} of 0.03±0.01% and PO_4^{3-} of 2.3±0.4%.

Seed culture and investigation of growth and germination parameters

The experiments consisted of a completely randomized design with two treatments, each with three replications. The experiments consisted of a completely randomized design with two treatments, each with three images. Therefore, six plates (trays) were randomly selected to check germination, each containing 50 seeds of lentil and rice.

Methods

In the first stage, two experimental treatments were conducted to study germination.

Study of lentil germination

Fifty grams of the organic fertilizer, produced from rice husk plus wood waste, was soaked in 500 ml of distilled water for 24 hours and filtered with Whatman filter paper. The extract was poured into a flask to be used for seed treatment. Therefore, two treatment experiments (seed cultivation) were conducted to soak the seeds. Two triplicate series of seed treatments were performed; one included seeds soaked in distilled water (as a control) and another in the extract obtained by filtering the soaked fertilizer under the study. At this stage, lentil seeds were selected for germination tests. Therefore, the study of lentil germination was carried out in different germination mediums of distilled water and filtered organic fertilizer with a concentration of 10% (volume/weight). The production of sprouts and roots of germinated seeds was observed daily [23, 24]. Three Pyrex plates were used for each experiment. Therefore, six plates were used for each germination test and related studies.

Study of germination and growth of rice seeds

Experimental cultivation of rice seeds was done based on a randomized complete block design. This experiment included different treatments in cultivation mediums with a combination of percentages of the discussed organic fertilizer and sandy soil with less than 1% organic matter and cultivations in the same sandy soil without fertilizer (as control). Light-colored plastic pots with a volume of about 500 cm^3 were used for experimental cultures (Figures 1 and 2). For each experiment (2.3.1 and 2.3.2), the observations and results obtained were analyzed using the appropriate methods below after acquisition. Three pots (three repetitions) were used for each treatment and twelve for each series of experiments. The organic fertilizer and sandy soil were mixed at 2/5:97/5; 5: 95, 5/7: 92/5, 10:90 (organic fertilizer: sandy soil by weight) and poured into the pots to a depth of about 20 centimeters. Then, 50 soaked seeds were planted in each of the banks. After the start of the treatment, the number of germinated seeds was examined every 24 hours, and the size of the stems and the roots were investigated as more time passed. Germination-related parameters were calculated using the following formulas obtained from the typical analytical instructions of Czabator (1962)[25].

The counts and measurements of germinated seeds were continued until 21 days after the start of the treatment. The final germination percentage of seeds was calculated for each treatment (pots). Also, the co-efficient germination (CG) was calculated using the following equations [26].

$$CG = (A_1 + A_2 + \ldots + A_x) / (A_1T_1 + A_2T_2 + \ldots + A_xT_x)100. \quad (1)$$

Where CG = Co-efficient of Germination (%), A =Number of seeds germinated, T = time corresponding to A, X = number of days to the final count.

To determine the vigor index, ten sprout samples were randomly selected from each pot, and the size of each shoot and its roots were measured using a ruler with an accuracy of 0.1 mm. Then, the germination capacity was calculated using the formula of Abdul-Baki and Anderson[27].

$$\text{Vigor index} = [\text{mean of root length(cm)} + \text{mean of shoot length (cm)}] \times \text{percentage of S.G} \quad (2)$$

Thus, the instructions for the seed germination test include three main steps:

First, prepare a volume of liquid extract from the desired organic fertilizer (compost) with the required concentration; second, Treatment of seeds in the liquid extract obtained from soaking organic fertilizer (compost) and distilled water (control); and third, Measure and calculating indices according to the results and data of experiments and using equations 1 to 6. These indexes include CG, Vigor index, seed germination (SG), relative seed germination (RSG), relative radicle growth (RRG), seed germination index (GI), and the Disease incidence%.

$$SG = \frac{NO.of\ germinated\ seeds \times 100}{NO.of\ total\ seeds} \quad (3)$$

$$RSG = \frac{NO.of\ germinated\ seeds(sample)}{NO.of\ germinated\ seeds\ (control)} \times 100 \quad (4)$$

$$RRG = \frac{total\ radicle\ length\ of\ germinated\ seeds(sample) \times 100}{tatal\ radicle\ length\ of\ germinated\ seeds(control)} \quad (5)$$

$$SSG = \frac{total\ shoot\ length\ of\ germinated\ seeds(sample) \times 100}{total\ shoot\ length\ of\ germinated\ seeds(control)} \quad (6)$$

After 21 days from the treatment (cultivation), the plants were uprooted and cleaned to evaluate the growth patterns. Various parameters were reported with specific measurements. Their fresh weight (10 pieces) and dry weight in grams were determined using a digital scale with an accuracy of 0.001 grams. The drop and decrease in disease development in the case of infected seedlings were calculated and reported using the following formula.

Disease incidence% = (Number of infected seedling) x100/Number of inspected seedlings (7)

The size (value) of germination (GV), which combines germination speed and total germination, was calculated using Djavanshir and Pourbeik equation [28].

GV= (DDGs/N) × GP/10 (8)

In equation 8, the variable DG is the daily germination rate obtained by dividing the cumulative germination percentage by the number of days after the last treatment. DDG is total germination and is obtained by adding daily measured DGs. N is the total number of measurement days starting from the first day of bud observation. GP is the germination percentage at the end of the test, and 10 is a fixed number. The mean germination time (MGT) was a speed index based on the ratio of faster germination to slower germination, and MGT values are according to the guidelines of Schelin et al. [25]. The treatments (cultivations) of the experiments included two different groups of culture mediums; one group consisted only of sandy soil, and the second group consisted of a mixture of sandy soil and the desired organic fertilizer (rice husk organic fertilizer plus wood waste) soaked in distilled water for 24 hours and then spread in Pyrex pellets for germination studies, and also used in plastic pots to study germination and growth of rice plants. The rice seeds were placed under the soil at a depth of approximately 0.3 cm and watered immediately after planting and whenever needed.

RESULTS AND DISCUSSION

Results

The results of the analyses of the organic fertilizer obtained from rice husk plus wood waste and additives mentioned in the materials and methods section, produced through the biochemical process and under optimal conditions, are reported in Table 1. These results show that the organic fertilizer has a relatively sufficient number of elements and nutrients needed for seed cultivation, germination, and growth of plants such as rice seeds, lentils, and other plants. The root and stem size of the cultivated samples and their germination rate and percentage were calculated ten days after seed cultivation.

Table 1: Result of the chemical analysis of rice husk plus woody waste organic fertilizer produced via the biochemical composting process.

pH (10/100)	Conduct. (10/100) (ms/cm)	OM* %	norg. M*. %	OC %	Ca^{2+} %	Mg^{2+} %	K^{+} %	PO_4^{3-} %	Nt %	Fe %	C/N
7±0.5	5.7±0.6	63.5±2.5	30±5	33.4±3	0.9±0.23	0.8±0.2	1.5±0.2	3.1±0.4	1.7±0.25	0.4±0.1	24.3±4

*OM: organic matter

Inorg. M: inorganic matter

The table of statistical analyses for all the investigated variables was compared using Minitab software, and the differences between SG variables were compared using T-test. The graphs were drawn using Excel software. The t-test for comparing SGs for lentil seed cultivation showed that there are significant differences between SGs over time; however, there are no significant differences between the SGs related to the lentil cultivation in distilled water and in the liquid obtained from soaking the studied fertilizer in distilled water at the same time (Table 2 and Figure 1).

Table 2: Effect of rice husk plus woody waste biochemical organic fertilizer aqueous extract (10%(w/v) on lentil seeds germination and growth of root and shoot length.

Treatment	Time (day)	SG %	SD	*SE	T-test	RSG %	CG %	Root length (cm)	shoot length (cm)	SSG %
**%10(w/v) (fertilizer/distilled water)	2	50±1.5	1.112	0.454	3.30	83.3	10.0	0.5	0.6±0.1	100
	4	59±1.0	0.948	0.387	2.58	84.3	7.5	3.8	4.5±0.5	150
	7	74.0±1.5	0.876	0.358	4.19	96.6	6.1	5.2	9.5±0.5	211
	14	77.6±1.4	0.964	0.394	3.55	97.0	5.5	6.4	24±0.5	218.2
	21	83±1.5	1.183	0.484	3.10	98.4	4.8	8.4	35±0.5	218.75
Distilled water (control)	4	70±1.0	0.68	0.278	3.60	-	5	11.8	16±0.5	-
	7	76.6±1.0	0.837	0.342	2.92	-	7.0	2.4	3±0.5	-
	14	80±1.0	0.749	0.306	3.27	-	6.4	3.2	4.5±0.5	-
	21	84.3±1.0	1.049	0.429	2.33	-	5.6	8.5	11±0.5	-
	24	60±1.0	0.93	0.380	2.63	-	10.0	0.4	0.6±0.1	-

*SE: standard error

**organic fertilizer aqueous extract(10%w/v)

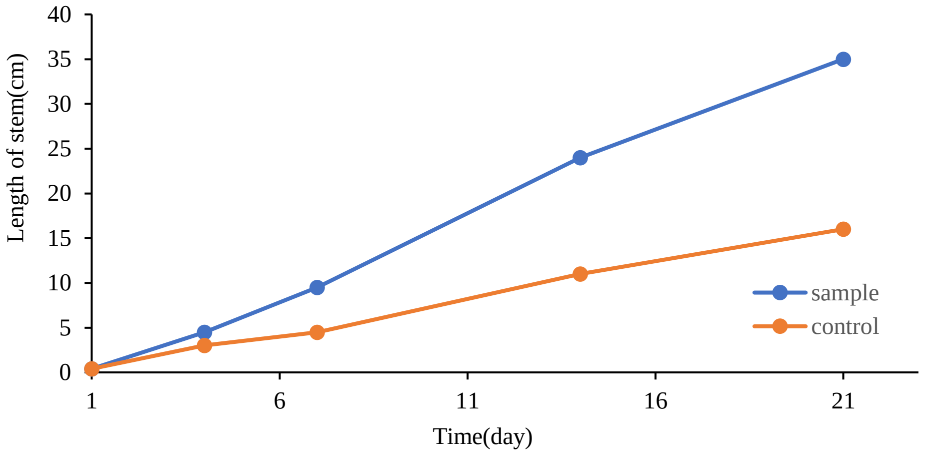

Figure 1: Increased stem length of lentils in the medium culture with a component of 5% rice husk plus woody waste organic fertilizer and 95% sandy soil with time.

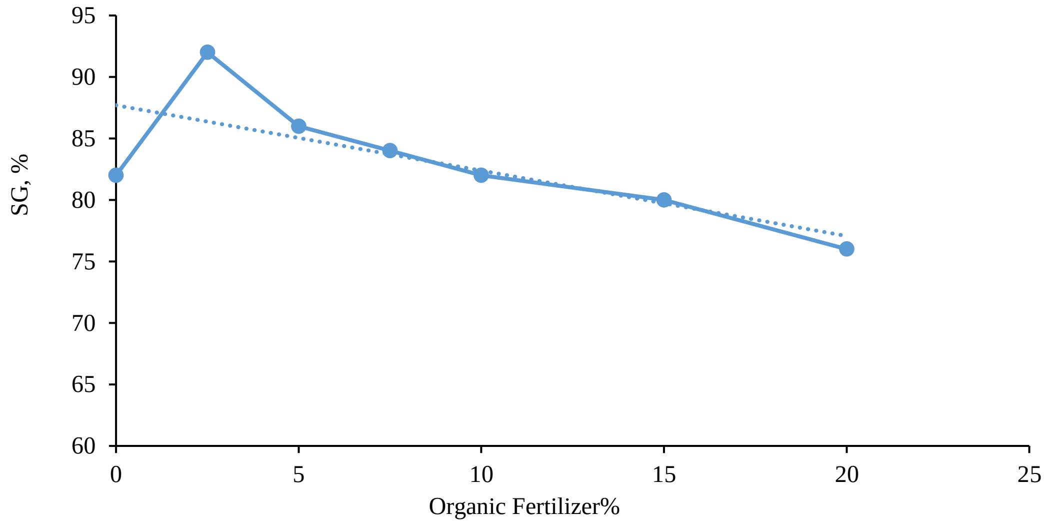

Figure 2: Differences of mean rice seed germination (SG%) in the seven growing mediums (different percent of rice husk plus woody waste organic fertilizer and sandy soil on medium culture).

There are relatively significant differences between the SGs related to rice seed cultivation in distilled water and the liquid extracted from organic fertilizer soaked in distilled water (Figure 2). In addition, the growth of the roots and stems of rice seeds in the cultivation medium containing 5 ± 2.5% organic fertilizer is about four times higher than that of sandy soil without organic fertilizer. These results showed the advantages of organic fertilizer obtained from rice husks with wood waste in increasing the growth of the roots and stems of rice seeds (Table 3 and Figures 3 and 4).

Table 3: Effect of organic fertilizer aqueous extract (10%(w/v) on seed germination and seedling growth of rice stem after 21 days.

Treatment	SG, %	SD	SE	T-test	RSG, %	Root length, cm	Shoot length, cm	Fresh weight 10 Germinate, g	Dry weight10 Germinate, g	Vigour index
**%10(w/v)	95.3±1	0.72	0.32	1.55	97	13.4±0.4	30.5±0.5	1.77±0.1	0.368±0.03	4183.67
(fertilizer/distilled	96.4±1	1.06	0.47	1.05	98.5	11.8±0.4	36.2±0.5	1.87±0.1	0.472±0.03	4627.2
water)	97.2±1	0.82	0.36	1.37	98.9	11.2±0.4	34.8±0.5	1.86±0.1	0.373±0.02	4471.2
Distilled water	98.2±1	0.64	0.29	3.49	-	3.1±0.1	11.4±0.2	0.92±0.1	0.185±0.02	1443.54
(control)	97.8±1	0.83	0.37	2.7	-	4.0±0.1	8.55±0.2	1.05±0.1	0.93±0.02	1437.66
	98.3±1	0.53	0.24	4.22	-	3.5±0.1	8.8±0.2	0.98±0.1	0.191±0.02	1248.41
GV(%)	6.3	-	-	-	-	2.3	6.24	-	-	-

* OrgF: organic fertilizer (compost)

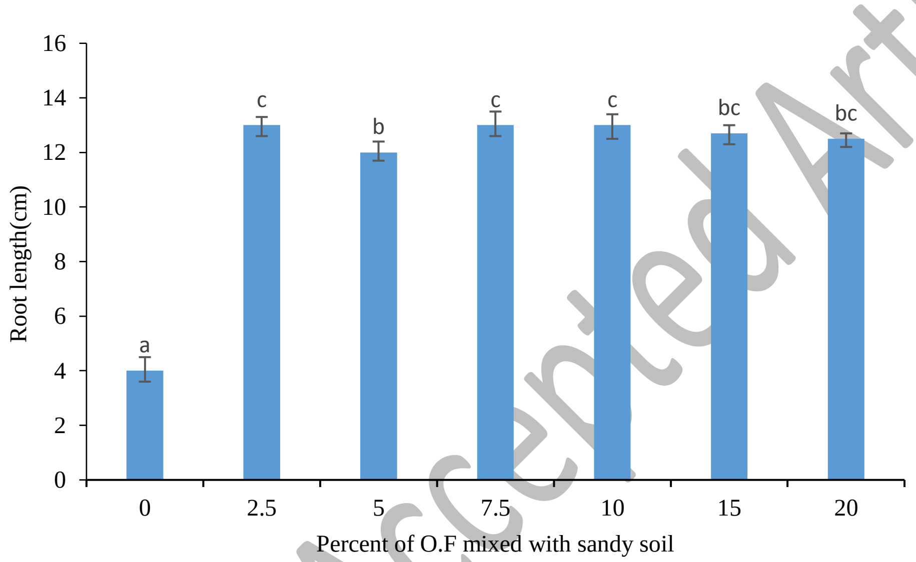

Figure 3: Increased root length of rice seedling in the medium culture with different components of rice husk plus woody waste organic fertilizer (O.F) and sandy soil after 21 days.

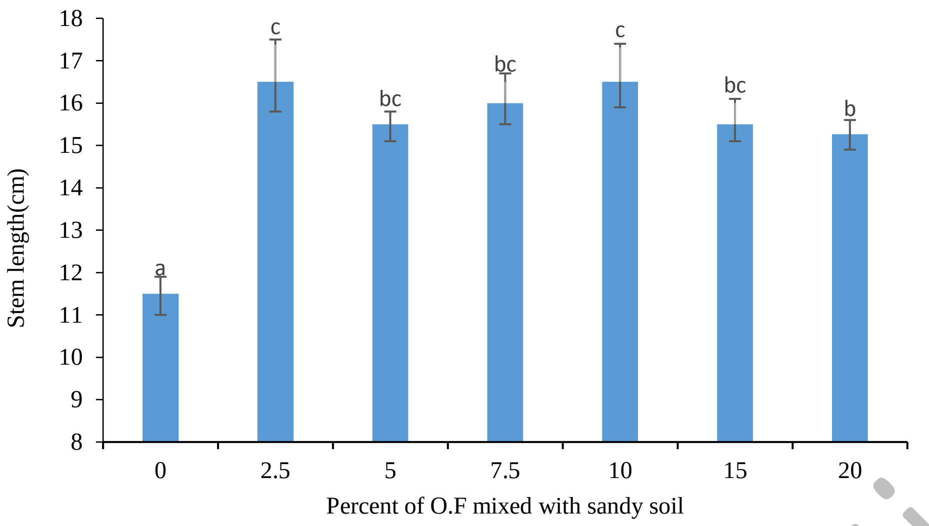

Figure 4: Increased stem length of rice seedling in the medium culture with different components of rice husk plus woody waste organic fertilizer and sandy soil after 21 days.

The investigation of cultivations of rice seeds in different cultivation mediums (a mixture of sandy soil and organic fertilizer under discussion) showed that the sandy soil cultivation medium containing 5 ± 2.5% organic fertilizer compared to the sandy soil without fertilizer was the best condition for rice seed germination and caused a 43% increase in stem growth and three times the root size (Table 4).

Table 4: Effect of different percentages of rice husk plus woody waste organic fertilizer (bio compost) on germination and seedling growth of rice seed.

Treatment	SG, %	Co-efficient of Germination, %	Root length, cm	shoot length, cm	Vigour index	No. of roots
%2.5(fertilizer/soil)	91.8±2	108	13±0.4	16.5±0.5	2777	4±1
%5(fertilizer/soil0)	84±2	98.1	12±0.4	15.5±0.5	2585.4	4±1
%7.5(fertilizer/soil)	81±3	96.5	13±0.3	16±1	2542	5±1
%10(fertilizer/soil)	86.5±4.5	100.8	13±0.4	16.5±1	2656.7	5±1
100% soil(control)	85±5	100	4±0.5	11.5±0.5	1338.8	3±1
GV(%)	4.0±01	4.79	0.6±0.1	0.70±0.01	-	

The continuation of table 4. *

treatment	No. of roots	Fresh wt. of 10 seedlings (g)	Dry wt. of 10 seedlings (g)	Root/ stem length ratio (NS)	% Damping off infected seedling
%2.5(fertilizer/soil)	4±1	1.7±0.05	0.37±0.02	0.7±0.1	5.7
%5(fertilizer/soil	4±1	1.8±0.1	0.47±0.02	0.75±0.02	8.3
%7.5(fertilizer/soil)	5±1	1.8±0.2	0.47±0.1	0.80±0.01	10
%10(fertilizer/soil)	5±1	1.5±0.1	0.34±0.1	0.80±0.01	11.7
100% soil(control)	3±1	1.0±0.1	0.21±0.01	0.4±0.1	16.7
GV(%)	-	-	-	-	-

These results showed that the rate and percentage of germination in all rice seed crops in the medium containing 5 ± 2.5% organic fertilizer in the sandy soil medium is significantly increased compared to the sandy soil medium without fertilizer, and the leaves of the rice plant are also greener in the mentioned medium. While the leaves were pale green in the sandy soil medium (Figures 5 and 6). Other measured parameters include root and stem growth, fresh weight, and dry weight of rice and lentil plants in the culture medium containing more than 7% organic fertilizer, which has caused a decrease in the percentage of germination, root growth, and stem growth (Table 4).

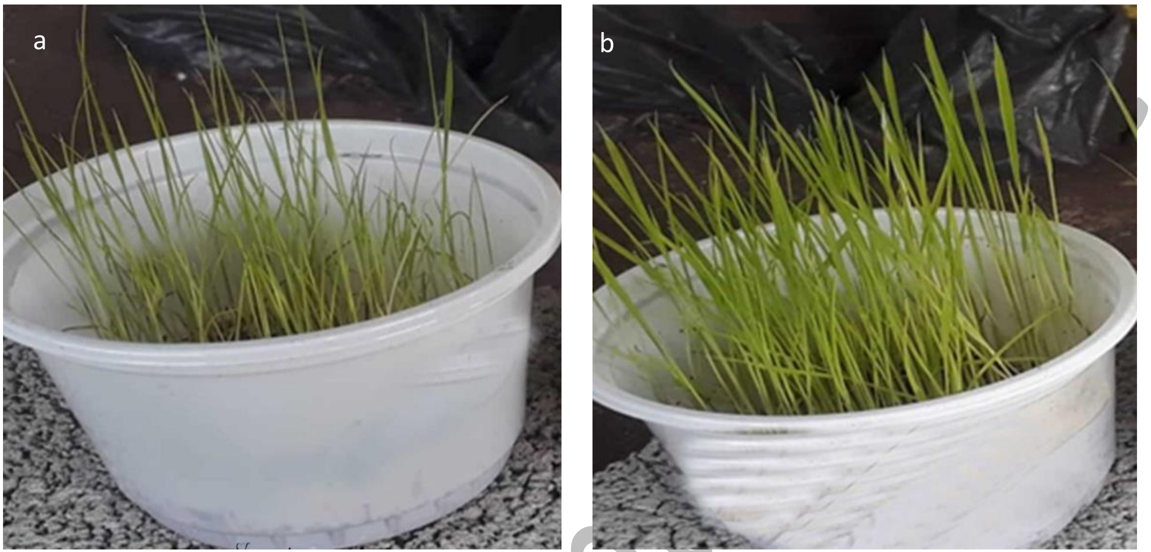

Figure 5. Seedling of rice seed: in sandy soil as control (a), in sandy soil plus 2.5% rice without organic fertilizer-stems plus woody waste organic fertilizer-stems and weak (b).

The germination percentage of rice and lentils with a probability of more than 95% ($p < 0.05$) is well affected by using about 5% of the discussed organic fertilizer (compost). These numbers are between 80 and 85% for lentils (Table 2) and 95.3 to 97.2% for rice seeds (Table 3). The results for the treatment of rice seeds in the culture medium containing different percentages of the discussed organic fertilizer in combination with sandy soil are shown in Table 4. According to the results in Table 4, the best germination occurred in the cultivation medium of 5 ± 2.5% organic fertilizer mixed with sandy soil. In this condition, there were drastic differences in the germination coefficient. This hybrid of the culture medium showed the best efficiency in velocity co-efficient of germination. It was equal to 108, and the weakest efficiency of 7.5 was seen in the sample related to the culture medium of sandy soil without organic fertilizer. The longest root of the plant, equal to 13.5 cm, was obtained in the cultivation medium with 7.5% organic fertilizer, and the shortest was 4 cm, obtained in the control culture bed (sandy soil without fertilizer) (Table 4).

Discussion

Seed germination is an essential event of the sensitive situation at the beginning of the plant growth stage, which shows its effectiveness and effects in the continuation of the growth of the seed in terms of sensitivity to soil and water pollution (environment). Therefore, the germination test (which is the stage before the process of plant photosynthesis) is used as a simple and relatively fast method (with a short time) to measure the toxicity of the culture medium (as a quality variable of the culture medium, including organic fertilizer). The seed germination test is an efficient, effective, and economical method of bioassay to estimate and determine the toxic capacity of biochemical fertilizer (bio-compost). This method is used before utilizing the organic fertilizer in the field or agricultural land (farm) for growing plants in a large area [25]. Since rice husk fertilizer, in addition to wood waste, has high silica. Because the rice plant also needs high silica to grow, in this study, rice seeds (local Hashemi) were selected for investigation. Due to the relatively high growth rate of lentil seeds, it was chosen to start the experiment. First, lentil seeds were soaked in distilled water (as a control) and in the extract obtained from soaking organic fertilizer in distilled water at a ratio of 10% (w/v) and treated separately. The first sprouts were observed and recorded in one day after soaking and continued for 21 days. After 21 days, due to the reduction or depletion of nutrients in the culture medium, the growth of roots and stems stopped or slowed down. After two days of soaking the seeds, germination occurred in each treatment. With the flow of water absorption from the culture medium, the seeds swelled rapidly, and their size and shape changed after 24 hours of soaking in distilled water and the extract mentioned above. Therefore, the necessary measurements and calculations were done through observations and investigations. In the second stage, the mentioned seeds were grown in two different culture mediums. One medium included sandy soil (as a control), and the second medium was a combination of sandy soil with different predicted proportions of the discussed organic fertilizer. The organic fertilizer obtained from rice husk and wood waste has high porosity, which is beneficial for supporting and helping the germination of rice and lentil seeds. High porosity in agricultural land facilitates and enhances the penetration of sufficient oxygen and water into the soil and subsequent absorption into the seeds. Sufficient oxygen and water penetration from the environment increases the respiration of the plant [29]. When the dry seeds come in contact with water, germination begins in the active sprout, and from this time, the roots gradually come out of their small pods[30]. According to the report of Abubakar Muhammad conducted in 2013, a fully active seed with germination capacity is affected by a wide range of variables related to the usual environmental conditions and according to the variables related to its species [31].

The effects of two seed treatment mediums on seed germination were reported. The percentage of lentil and rice germination in the liquid separated from the above-mentioned organic fertilizer soak was 77.8, and 96.7%, respectively, and this factor had a maximum value for distilled water, 80.9% and 98.1%, respectively. The statistical difference between the results in the two treatment mediums was insignificant at $p< 0.05$. The changes in other variables were also reported for both growth mediums. The highest SG obtained in the liquid medium extracted from organic fertilizer was 84.1% for lentils and 97.2% for rice seeds. The lowest of this parameter was 76% for lentils and 84% for rice seeds, respectively. A significant difference in SG between the two culture environments was statistically observed at $p< 0.05$ (Table 3). A significant statistical difference was observed in SG between the two culture mediums at $p< 0.05$ (Table 3). The difference in seed germination variables such as SG, RSG, CG, root size, and stem length for rice and lentil seeds for the two culture mediums of distilled water and liquid extracted from the discussed organic fertilizer soaking was insignificant at $p< 0.05$. These variables were significantly higher in the cultivation medium resulting from the combination of organic fertilizer and sandy soil than in the pure medium of sandy soil at $p<0.05$ (Table 4). It shows that the extract from soaked fertilizer is not toxic for seed germination. On the other hand, it has a positive effect on the content of nutrients in the fertilizer. It facilitates the penetration and maintenance of water and oxygen to the seed, increasing the rejuvenation and growth of the stem and the root. The results related to CG, RSG, and others are comparable with the results reported by Kumar in 2013 regarding the germination of Stevia rebaudiana in the medium of rice husk culture, that the germination of the above seed in the medium of rice husk was 4.57[32]. Also, in the report by Yerima et al. in 2015[33], the germination percentage for Helianthus annuus sunflower seeds in the culture medium obtained from rice husk and soil was 78.

In all the ranges of measured parameters regarding germination and growth, such as root and shoot size in this experiment, it was determined that 5±2.5% of organic fertilizer produced from rice husks plus wood waste through the process of biochemical composting in the combination of sandy soil culture medium has a favorable result and will be effective in lentil and rice seed germination. The culture medium obtained from the organic fertilizer discussed in this study and what is in the report of Milla et al. contain a high amount of silicate and also have a significant amount of nitrogen, potassium, phosphorus, iron, and other elements, and nutrients that are used to improve agricultural soil[34]. The quality of the discussed culture medium showed better efficiency in reducing seed diseases compared to the culture medium containing Trichocompost and Vermicompost[34]. Regardless of the passage of time after the start of soaking the rice seeds, the highest effect in reducing the diseases was seen in an experiment where the culture medium contained 2.5% and 5% organic fertilizer in combination with sandy soil. These findings are supported by many reports by different researchers about many composts, such as poultry waste compost, Trichocompost, Vermicompost, and biological leachate from cow dung in the study of potato germination [35]. In this way, the organic fertilizer obtained from rice husks with the addition of wood waste using the biochemical composting process has the ability and quality to be used in the production of agricultural products such as rice and lentils, which not only does not cause toxicity in germination, it can also strengthen the growth and development of the plant both in terms of roots and stems due to the content of the elements and materials needed by the plant.

CONCLUSIONS

The rice husk plus woody waste biochemical organic fertilizer (produced by the authors) as a growing medium is recommended for the germination of seed and the early seedling growth of rice and lentils according to the results of this experiment comparing sandy soil growing media. The peak value for germination in the soaked rice husk plus woody waste organic fertilizer as a growing medium was significantly higher than in the soaked sandy soil and distilled water. In the rice husk plus woody waste aqueous medium with 5 ± 2.5% organic fertilization mixed with sandy soil, the number and length of roots in rice and lentil seedlings were significantly greater than in sandy soil and distilled water. On the other hand, there were no significant statistical differences between the mediums in germination percentage, speed of germination, mean germination time, mean daily germination, germination value of the seeds, and leaf number, length, width, and fresh weight of seedlings.

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