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Evaluation of Seed Germination of Barley Grown after Priming with Leaf Extract of Moringa and Aqueous Garlic Extract

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Abstract

A pot experiment was designed to determine the effect of seed priming on the germination of barley seeds in the winter season. Seed priming was done by using the leaf extract of Moringa at different concentrations (100%, 50% and 10%v/v) for 24 hours, and aqueous extract of ginger and tap water for different intervals of time (6, 12 and 24 hours). The experiment was continued for ten days with nine seed priming treatments. The results showed that maximum seeds germinated on day nine in all treatments. Whereas the highest germination of seeds was observed when seeds were primed with an aqueous extract of garlic for 24 hours and when seeds were primed with 100% concentration of Moringa leaf extract for 24 hours. The lowest seed germination was observed when seeds were primed with an aqueous extract of garlic for 6 hours. These results showed that Moringa leaf extract and aqueous garlic extract can be used to prime barley seeds to improve germination.

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Introduction

Abiotic stress and pollution in the environment are the main problems in the world, which affect the germination of seeds, plant development and crop yield [1, 2]. A simple technique is seed priming which can enhance the seed germination and growth and yield of a crop [3]. Seed priming is an easy and affordable process, in which seeds got wet to a point where all the metabolic activities start before the actual germination [4]. Priming of seeds can refine the strength of seeds and intensify the rate and consistency of germination, which helps a lot to manage salt stress, drought and other damages [5]. When soil is affected by salt, it delays the growth of young plants. By using the technique of seed priming, we can reduce the salt stress for the crop and get a better yield [6]. The seed priming method is used in many countries, including Pakistan, China and India to get better yield and growth of a crop. Under both non-saline and saline conditions, seed priming has been reported to offer better seed germination and ultimately better crop yield [7]. We can prime the seed by using different methods that may be hormonal priming, osmo-priming, hydro-priming and halo-priming [8]. Onsite seed priming is an easy, inexpensive and successful method for better growth in which seeds are soaked overnight and then dry them and sow to obtain a higher germination rate [5].

Moringa *(Moringa oleifera)* is a member of the family *Moringaceae* and the most extensively used species. Some hormones like cytokines and zeatin are present in the leaves of Moringa [9]. Seed priming with Moringa leaf extract improves germination and seedling growth due to the presence of zeatin. Zeatin plays an important role in cell division and cell elongation and promotes plant growth [9]. Similarly, garlic (*Allium sativum L.*) belongs to the family *Alliaceae* and garlic cloves have oil, which is rich in sulfur-containing compounds like alliin, allicin, ajoene, etc. [10]. Garlic extract has a high alimental value that contains more than 200 biochemical compounds and enzymes that have biological activity and enhance plant growth. In this study, we used leaf extract of Moringa and aqueous garlic extract as seed priming treatments to evaluate their effect on seed germination of barley. Barley (*Hordeum vulgare* L.) is one of the cereal crops that are used as a food source for humans and animals. The barley seeds were primed and germination rate was determined.

Materials and Methods

The experiment was conducted at the University of Okara, Renala Khurd, Punjab, Pakistan located at coordinates 30°52′ 04. 19″N and 73°34′08. 45″E. Barley was selected for the experiment to check the effect of seed priming, and its seeds were bought from the market. Leaves of Moringa were collected from a nursery located in Pattoki, Pakistan. Around 250 g of leaves were detached and washed with tap water to remove dirt particles. Later, these leaves were chopped, ground, filtered through the muslin cloth and diluted to different concentrations (100%, 50% and 10% v/v). Similarly, around 300g of garlic cloves were collected, peeled and chopped in a granite mortar. Later, chopped cloves were steeped in 200 ml of water for one day and filtered through a muslin cloth. The following treatments were arranged for this experiment: T0 = no priming (control); T1 = seed primed with 100% conc. of Moringa leaf extract for 24 hours; T2 = seed primed with 50% conc. of Moringa leaf extract for 24 hours; T3 = seed primed with 10% conc. of Moringa leaf extract for 24 hours; T4 = seed primed with aqueous garlic extract for 24 hours; T5 = seed primed with aqueous garlic extract for 12 hours; T6 = seed primed with aqueous garlic extract for 6 hours; T7 = seed primed with tap water for 24 hours; T8 = seed primed with tap water for 12 hours; T9 =seed primed with tap water for 6 hours. A pot experiment was conducted that was comprised of nine different treatments in triplicate. Pots were filled with 350 g of soil, which was a mixture of clay and sand (1:1 ratio). After priming, five seeds were sown in pots at an equal distance from each other. Each pot was irrigated with tap water regularly after 24 hours. The number of seeds germinated up to ten days were counted and the mean values were calculated. To analyze the data, ANOVA was performed followed by Tukey's test by using Statistics 8.1 software (Analytical Software, Tallahassee, USA).

Results and Discussion

Seed priming enhanced the germination rate and protects the germinating seeds and seedlings against the soil. Under unfavorable climatic conditions, the priming of seeds enables them for a higher germination rate. The moisture content, temperature of seed and uniformity of the seed emergence are improved, while germination time is shortened [1]. In this study, we determined the

Table 1 Average seed germination rate of barley primed with different concentrations of Moringa leaf extract for 24 hours and aqueous garlic extract for 6, 12 and 24 hours.

	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	Mean
D7	2.00^{fg}	4.33^{abc}	3.33^{cde}	3.66^{bcde}	4.66^{ab}	2.66^{efg}	1.66^{g}	3.00^{def}	2.66^{efg}	4.33^{abc}	3.23^{c}
D8	3.66^{bcde}	4.33^{abc}	3.66^{bcde}	4.66^{ab}	5.00^{a}	3.00^{def}	2.66^{efg}	2.00^{fg}	4.00^{abcd}	3.66^{bcde}	3.66^{b}
D9	3.66^{bcde}	4.66^{ab}	3.66^{bcde}	4.66^{ab}	5.00^{a}	3.66^{bcde}	3.00^{def}	3.66^{bcde}	3.33^{cde}	4.33^{abc}	3.96^{ab}
D10	3.66^{bcde}	4.66^{ab}	3.66^{bcde}	4.66^{ab}	5.00^{a}	3.66^{bcde}	3.33^{cde}	3.66^{bcde}	3.66^{bcde}	4.33^{abc}	4.03^{a}
Mean	1.18^{cd}	1.63^{a}	1.30^{bc}	1.60^{a}	1.78^{a}	1.18^{cd}	0.96^{d}	1.12^{cd}	1.24^{bcd}	1.51^{ab}	

D = days; T = treatments

effect of leaf extract of Moringa, aqueous garlic extract and tap water on barley seed germination and results are presented in Table 1. The data regarding seed germination are highly significant (F = 1.44, p = 0.019). The results showed that overall, maximum germination of seeds was observed at days 9 and 10. Whereas the highest germination of seeds was observed in treatment T4 in which seeds were primed with aqueous garlic extract for 24 hours; however, it was nonsignificant with T1, T3 and T9. Other scientists reported that seed priming with aqueous garlic extract for 12 hours enhanced the rate of germination of eggplant [11]. The aqueous garlic extract has high alimental value, which contains more than 200 biochemical compounds and many important enzymes, which are plant growth regulating compounds. Garlic is also considered a medicinal plant species and holds an amazing result for its active role in cardiological complications and anti-cancer [12]. In this study, seed germination was also enhanced in treatment T1, in which seeds were primed with 100% conc. of Moringa leaf extract for 24 hours. Some hormones like cytokines and zeatin are present in the leaves of Moringa; besides, some phenols, carotenoids and nutrients like calcium are also present in the leaves of Moringa that promote and intensify the plant growth [9]. In a previous report, seed priming with 10% and 100% conc. of Moringa leaf extract enhanced the rate of germination while at 50% conc., it decreased the seed germination [13]. The results showed that priming with aqueous garlic extract for 24 hours and 100% conc. of Moringa leaf extract for 24 hours could be beneficial to improve seed germination of barley. For priming of other plant species, we recommend that aqueous garlic extract and Moringa leaf extract should be tested.

Conflict of interest

The authors claim no conflicts of interest.

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