



Increasing Of Germination By Hydropriming Method In Radish (*Raphanus Sativus L.*)

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ABSTRACT

An experiment was carried out using a completely randomized design with three replications on germination in radish (*Raphanus sativus L.*) seed's at Islamic Azad University Shahr-e-Qods Branch, Tehran, Iran in 2011. The factor of study included different time hydropriming (control, 12 and 24 h). The characters measured were: germination percentage, seedling dry weight and seedling vigour. The results showed that effect of hydropriming significant on germination percentage, seedling dry weight, and seedling vigour in $P \leq 0.05$. Mean comparison showed that the highest germination percentage (83 %), seedling dry weight (0.025 g) and seedling vigour (2.70) were achieved by 24 h hydro priming.

Key words: Hydropriming, Germination percentage, Seedling dry weight, Seedling vigour and Radish.

Introduction

Radish (*Raphanus sativus L.*) is an anciently annual or biennial cultivated vegetable. It most likely originated in the area between the Mediterranean and the Caspian Sea [2]. It may come from the wild radish in southwest China [1]. It is possible that radishes were domesticated in both Asia and Europe. According to Herodotus (c. 484-424 BC), radish was one of the important crops in ancient Egypt, as radish was depicted on the walls of the Pyramids about 4000 years ago. Cultivated radish and its uses were reported in China nearly 2000 years ago [3] and in Japan radishes were known some 1000 years ago [2].

Based on recent studies using chloroplast single sequence repeats (cpSSRs), Yamane *et al.* [6] postulate three independent domestication events which include black Spanish radish and two distinct cpSSR haplotype groups. One of the haplotype groups is geographically restricted to Asia, presenting higher cpSSR diversity than cultivated radish from the Mediterranean region or wild radish types. This implies that Asian cultivated radish cannot be traced back to European cultivated forms which spread to Asia, but might have originated from a still unknown wild species that is different from the wild ancestor of European cultivated radish [6]. Today, radishes are grown throughout the world. Different local people prefer to use various parts of the radish plants including roots, leaves, sprouts, seed pods and oil from seeds as their food according to their own custom. Radishes are low in calories and high in vitamin C, folate, and potassium. Radishes

contain sulfurous compounds, such as sulforaphane, which have anti-cancer properties, and are expectorant. The early domestication of radishes, evolutionary processes and human selection of preferred types have led to significant variations in size, color and taste of this vegetable crop. Among them, small-rooted radishes are grown in temperate regions of the world and harvested throughout the year [2]. Larger-rooted cultivars such as Chinese radish are predominant in East and Southeast Asia. World production of radish roots is estimated at 7 million t per year, about 2% of the total world production of vegetables. In China, Japan and Korea, as well as in Yemen, radish ranks high in importance. Radish (*Raphanus sativus L.*) belongs to the Brassicaceae (alt. Cruciferae) family with chromosome numbers $2n = 2x = 18$. The cultivated radishes have several wild relatives such as *R. raphanistrum* and its subspecies *landra* (Moretti ex DC.) Bonnier & Layens, *maritimus* (Sm.) Thell., *microcarpus* (Lange) Thell., *raphanistrum*, *rostratus* (DC.) Thell.; and *R. confusus* (Greuter & Burdet) Al-Shehbaz and Warwick. Pistrick [4] divided cultivated radishes (*Raphanus sativus L.*) into three groups: convar. *oleifera* (*Raphanus sativus* var. *oleiformis* Pers.), also called *R. sativus* Leaf Radish Group [5], oilseed and fodder radishes, which are grown in Southeast Asia and in Europe for leaf fodder, and as green manure. Convar. *caudatus* (*Raphanus sativus* var. *caudatus* (L.) L. H. Bailey), also known as *R. sativus* Rat-Tailed Radish Group [5] - the rat-tail radish (also known as mougri, radis serpent) grown for its edible immature green or purple seed pods and

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leaves. This type is grown in Southeast Asia. Convar. *sativus* (*Raphanus sativus* var. *sativus*), also known as *R. sativus* Small Radish Group [5], where all forms are with edible roots, leaves and germinated radish sprouts, with many different varieties but generally of the small type (radish, small radish, turnip radish, petit rave). *Raphanus sativus* L. var. *niger* J. Kern, also known as *R. sativus* Chinese Radish Group with the common names Chinese radish, Japanese radish, and Oriental radish are recognized by Wiersema and León [5] as fourth cultivated group. Radishes can be classified in different ways: small-rooted (sometimes referred to as var. *radicula*) and large-rooted types (including names such as var. *nigra*, *niger*, *sinensis*, *acanthiformis* or *longipinnatus*) based on root size; European, Chinese, Indian and Japanese based on geography; spring or summer radish and winter radish, Chinese radish (var. *longipinnatus* Bailey) and all-season radish (var. *radiculus* Pers.) based on the adaptation to growing seasons and regions [7]. Radish is an important root and leafy vegetable throughout the world. The small-rooted and short-season type of radish is cultivated for salads and as fresh vegetable. The large-rooted type of radish is usually cooked, canned or pickled besides being eaten raw. The leaves and sprouts are used as salad or are cooked, too. The seed pods are cooked for soups in southwest China and Southeast Asia. People press seeds of *Raphanus sativus* to extract oil. Wild radish seeds contain up to 48 percent oil, which is not suitable for human consumption but has promise as a source of biofuel. Farmers also grow oil radishes to improve and fertilize the soil and as fodder. In traditional medicine, radishes are used as one of nonpoisonous materials to treat coughs, cancer, whooping cough, gastric discomfort, liver disorders, constipation, dyspepsia, gallbladder disorders, arthritis, gallstones, and kidney stones. This experiment was conducted to increasing of germination by hydro priming method in radish (*Raphanus sativus* L.).

Materials and Methods

This experiment was carried out using a completely randomized design with three replications on germination in radish (*Raphanus sativus* L.) seed's at Islamic Azad University Shahr-e-Qods Branch, Tehran, Iran in 2011. The factor of study included different time hydropriming (control, 12 and 24 h) through the placing seeds was exposed to water. After disinfecting, seeds were put in disinfected Petri dish. Each Petri dish contained 100 seeds. Three replicates of 100 seeds were put between double layered rolled. The rolled paper with seeds was put into sealed plastic bags to avoid moisture loss. All of the Petri dish irrigated by distilled water. Seeds were allowed to germinate at $25 \pm 3^{\circ}\text{C}$ for 7 days. Germination percentage was recorded after the 7th day. Germination percentage was calculated with the following formula:

$$\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Number of total seeds}} \times 100$$

Also, Seedling vigor index was calculated by the following formula:

$$\text{Seedling vigor index} = \text{Germination percentage} \times \text{Seedling dry weight}$$

Statistics Analysis:

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (Spss) computer software at $P < 0.05$.

Results and Discasion

Germination Percentage:

The results showed that the effect of hydro priming was significant on germination percentage in $P \leq 0.05$. The highest germination percentage (83 %) was achieved by 24 h hydro priming and lowest germination percentage (61 %) was achieved by control treatment (Table 1, Fig 1).

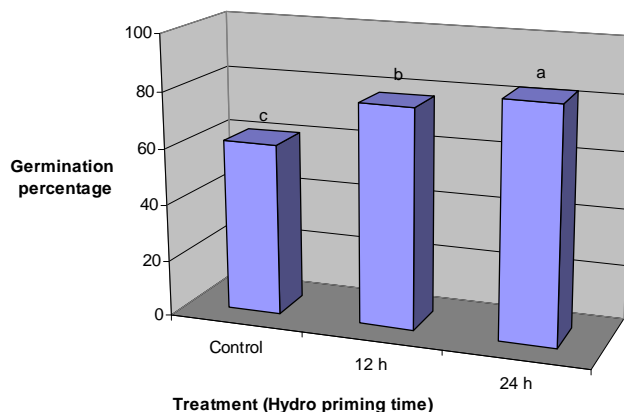


Fig. 1: Effect of hydro priming on germination percentage in radish.

Seedling Dry Weight:

The results showed that the effect of hydro priming was significant on seedling dry weight in $P \leq 0.05$. The highest number of grain (0.025 g) was achieved by 24 h hydro priming and lowest seedling dry weight (0.013 g) was achieved by control treatment (Table 1, Fig 2).

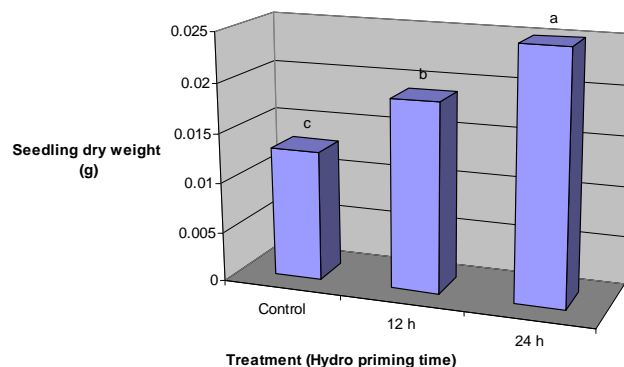


Fig. 2: Effect of hydro priming on seedling dry weight in radish.

Seedling Vigour:

The results showed that the effect of hydro priming was significant on seedling vigour in $P \leq 0.05$. The highest seedling vigour (2.70) was achieved by 24 h hydro priming and lowest seedling vigour (0.79) was achieved by control treatment (Table 1, Fig 3).

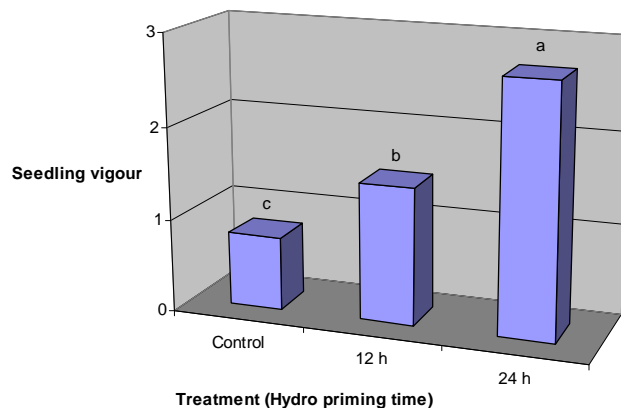


Fig. 3: Effect of hydro priming on seedling vigour in radish.

Table 1: Means Comparison

Treatment (Hydro priming time)	Germination percentage	Seedling dry weight (g)	Seedling vigour
Control	61 ^c	0.013 ^c	0.79 ^c
12 h	78 ^b	0.019 ^b	1.48 ^b
24 h	83 ^a	0.025 ^a	2.70 ^a

Means within the same column and factors, followed by the same letter are not significantly difference.

Seed priming is a pre-germination seed treatment in which seeds are held at water potential that allows imbibition, but prevents radicle extension [8]. Seed priming has been used to improve germination, reduce seedling germination time, improve stand establishment and yield [9]. In priming enhancement of physiological and biochemical events in seeds takes place during suspension of germination by low osmotic potential

and negligible matric potential of the imbibing medium. Salts or non-penetrating organic solutes in liquid medium (osmoconditioning) or solid matrices (matricconditioning) are used to establish an equilibrium of water potential between seed and osmotic medium needed for conditioning [9]. Priming also expands the temperature range at which germination may occur [10]. Seed priming is a technique in which seeds are partially hydrated until

the germination process begins, but radicle emergence does not occur [8]. Priming allows the metabolic processes necessary for germination to occur without actual germination. Primed seeds usually exhibit an increased germination rate, greater germination uniformity, and, at times, greater total germination percentage [15]. Increased germination rate and uniformity have been attributed to metabolic repair during imbibition [15], buildup of germination enhancing metabolites [15], osmotic adjustment [8], and, for seeds that are not redried after treatment, a simple reduction in imbibition lag time [8]. Other scientists have given excellent reviews on seed priming. The beneficial effects of priming have also been demonstrated for many field crops such as wheat, sugar beet, maize, soybean and sunflower [13,11,14].

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