Increasing of Seedling Vigour By Thermo Priming Method In Radish (*Raphanus sativus* L.)

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ABSTRACT

In order to determine the impact of thermo priming on germination of radish seeds, an experiment was conducted at Islamic Azad University, Takestan Branch, Takestan, Iran in 2011 by a completely randomized design with three replications. The factors studied included different time thermo priming (0, 10 and 20 minutes) through the placing seeds were exposed to oven. The results showed that the effect of thermo priming was significant on germination percentage, seedling dry weight, seedling vigour and seedling length in \( P \leq 0.05 \). Mean comparison showed that the highest germination percentage (81 %), seedling dry weight (0.020 g) and seedling vigour (1.62) were achieved by 10 minutes thermo priming.

Key words: Thermo priming, Seedling, Seedling production, Seedling vigour and Radish.

Introduction

*Raphanus raphanistrum* L. is the most likely ancestor of the polymorphic *Raphanus sativus*. The area of maximum diversity of radish lies between the eastern Mediterranean and the Caspian Sea, which is probably the original gene centre for this species. Radish was cultivated already in ancient times in the Mediterranean, from where it spread to China in about 500 BC and to Japan in about 700 AD. The variability diminishes gradually from the Caspian Sea to China, and even more towards Japan. It is also a crop that has been cultivated since ancient times in the oases of the Sahara and in Mali. Radish can now be found as a cultigen throughout the world in many different forms, from small leafy annuals to biennials with large fleshy roots. The cultivars with relatively small roots (small radish) are most important in temperate climates of the world and only of limited importance in Africa, mostly in francophone countries amongst people originating from Europe. Larger-rooted cultivars (like Chinese radish) are most important in East and South-East Asia. In East Africa and elsewhere in the cooler parts of the African continent, large, white radishes are known under the Swahili/Arabic name ‘fijili’ and the Hindi name ‘mooli’ and these are becoming increasingly popular. In francophone West Africa Chinese radish is becoming popular, replacing the traditionally grown vegetable turnip (*Brassica rapa* L.), which is very susceptible to anthracnose. Large radishes with a dark grey-brown surface are occasionally seen in southern Africa and are sold under the name ‘black Spanish radishes’; they are more commonly grown in Europe under the name ‘black radish’. The so-called ‘rat-tailed radish’, grown for its green or purple 20–60 cm long pods, is rather important in India and eastern Asia, but only of minor importance for Asian immigrants in East Africa, where it is called ‘mogri’. Finally, the so-called ‘leaf radish’ is gaining importance in Europe and South Africa as forage and green manure but is not known to be cultivated in tropical Africa. In summary, radish occurs scattered throughout Africa; it has been recorded for over a dozen counties, from Mali to Eritrea, and southwards to South Africa and the Indian Ocean islands, but is probably cultivated in many more. It is commonly recorded as an escape from cultivation. Radish is grown mainly for its thickened fleshy root. Small radishes are pungent and used as appetizer when eaten fresh and for adding colour to dishes. Oriental radish (to which Chinese radish, Japanese radish and mooli belong) is crisp with a mild flavour. The roots are thinly peeled, sliced or diced and put into soups and sauces or cooked with meat. They can be preserved in salt. Oriental radish can also be eaten fresh, mixed with other vegetables such as tomato. Also the leaves are eaten as salad or spinach. Seedlings known as radish sprouts are used as greens for appetizers in the same way as cress (*Lepidium sativum* L.) or cooked as spinach. Rat-tailed radish is grown for the immature crisp, fleshy fruits.
consumed raw, cooked or pickled, but the roots are not edible. Leaf radish is mainly grown as green manure and forage in central and western Europe and is also grown as fodder for cattle in South Africa. There are forms of radish that are used as an oil-seed crop but these are not known to be grown in Africa. In traditional medicine, radish is used to treat hepatic disorders, bronchitis and coughs. World production of radish roots is estimated at 7 million t per year, about 2% of the total world production of vegetables. In Japan, Korea and Taiwan, but also in Yemen, radish ranks high in importance. No production data are known from tropical Africa but its significance is minor when compared with Asia or Europe. The composition of the raw root of white radish (mooli) per 100 g edible portion (87% of the product as purchased) is: water 93.0 g, energy 64 kJ (15 kcal), protein 0.8 g, fat 0.1 g, carbohydrate 2.9 g, fibre 1.5 g, Ca 30 mg, P 25 mg, Fe 0.4 mg, carotene 0 μg, thiamin 0.03 mg, riboflavin 0.02 mg, niacin 0.5 mg, ascorbic acid 24 mg. The composition of the raw leaves per 100 g edible portion (90%) is: water 89.7 g, energy 137 kJ (33 kcal), protein 3.5 g, fat 0.5 g, carbohydrate 3.5 g, Ca 200 mg, P 44 mg, Fe 3.8 mg, carotene 3670 μg, thiamin 0.13 mg, riboflavin 0.35 mg, niacin 0.8 mg, ascorbic acid 63 mg [1].

This experiment was conducted to increasing of seedling vigour by thermo priming method in radish (Raphanus sativus L.).

Materials And Methods

In order to determine the impact of thermo priming on germination of radish seeds, an experiment was conducted at Islamic Azad University, Takestan Branch, Takestan, Iran in 2011 by a completely randomized design with three replications. The factors studied included different time thermo priming (0, 5 and 10 minutes) through the placing seeds were exposed to oven. 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 ± 3°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 vigour index was calculated by the following formula:

\[
\text{Seedling vigour index} = \text{Germination percentage} \times \text{Seedling dry weight}
\]

Statistics Analysis:

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

Results and Discussion

Germination Percentage:

The results showed that the effect of thermo priming was significant on germination percentage in P ≤ 0.05. The highest germination percentage (81 %) was achieved by 10 minutes thermo priming and lowest germination percentage (70 %) was achieved by control treatment (Table 1, Fig 1).

Fig. 1: Effect of thermo priming on germination percentage in radish.
**Seedling Dry Weight:**

The results showed that the effect of thermo priming was significant on seedling dry weight in $P \leq 0.05$. The highest number of grain (0.020 g) was achieved by 10 minutes thermo priming and lowest seedling dry weight (0.012 g) was achieved by control treatment (Table 1, Fig 2).

![Graph showing seedling dry weight](image1)

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

**Seedling Vigour:**

The results showed that the effect of thermo priming was significant on seedling vigour in $P \leq 0.05$. The highest seedling vigour (1.62) was achieved by 10 minutes thermo priming and lowest seedling vigour (0.84) was achieved by control treatment (Table 1, Fig 3).

![Graph showing seedling vigour](image2)

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

<table>
<thead>
<tr>
<th>Treatment (Thermo priming time)</th>
<th>Germination percentage</th>
<th>Seedling dry weight (g)</th>
<th>Seedling vigour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>70 c</td>
<td>0.012 c</td>
<td>0.84 c</td>
</tr>
<tr>
<td>5 minutes</td>
<td>76 b</td>
<td>0.017 b</td>
<td>1.29 b</td>
</tr>
<tr>
<td>10 minutes</td>
<td>81 a</td>
<td>0.020 a</td>
<td>1.62 a</td>
</tr>
</tbody>
</table>

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

Likewise, Harris *et al.*, [2] reported that the direct benefits of seed priming in all crops included faster emergence, better, more and uniform stands, less need to re-sow, more vigorous plants, better drought tolerance, earlier flowering, earlier harvest and higher grain yield. Under field conditions poor seed quality not only reduces the final crop stand but also delays the onset of germination and adversely affects the seedling vigour. Seed quality is considered as a major tool of a variety development in seed production and breeding process. Seed quality should be taken as a complex of biological value and other seed parameters. In the practice the expression seed quality is used loosely to reflect the
overall value of seed for its intended purpose, the performance of seed must measure up to the expectations of the end user of that seed [3]. Lower germination and vigor in the seeds from the crop cultivated during summer is ascribed to the high atmospheric temperatures during pod drying [4,8] and high relative humidity during subsequent storage [5,7,6]. Physiological maturity of seed at harvest is usually defined as the time when seed attains its maximum dry weight [9]. However, reports are available on differences in seed size, and germination and seedling vigour in groundnut [11,10]. Fast germination is due to the synthesis of DNA, RNA and protein during priming [13]. The increased plant biomass might be due to synchronized germination and early stand establishment in treated seeds [12].

References