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ORIGINAL ARTICLE

Effect of Thermopriming on Germination of Cowpea (Vigna Sinensis L.)

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Hossein Aliabadi Farahani, Payam Moaveni and Kasra Maroufi: Effect of Thermopriming on Germination of Cowpea (Vigna Sinensis L.)

ABSTRACT

In many crops pre-soaking or priming causes improvement in germination and seedling establishment. Thermo priming is a new method for increasing of seedling vigour and improvement of germination percentage and seedling growth. In order to determine the impact of thermo priming on germination of cowpea seeds, an experiment was conducted at Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran in 2011 by a completely randomized design with three replications and the first, seed viability was determined by Tetrazolium test method. 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 $P \leq 0.01$. Mean comparison showed that the highest germination percentage (90 %), seedling dry weight (2.05 gr), seedling vigour (184.5) and seedling length (8.58 cm) were achieved by 10 minutes thermo priming. Finally, thermo priming treatment can be successfully applied on cowpea seeds to improve germination performance.

Key words: Thermo priming, germination, seedling vigour, seedling growth and cowpea.

Introduction

Cowpea (*Vigna sinensis* L.) is a legume of the family Fabaceae. It has been described as the poor man's meat [2]. It's grown for dry seeds and as leafy vegetables in different parts of the world [36]. They resist drought stress and can recover rapidly during vegetative growth stage by re-watering because of their efficiency in using soil water [12]. Poor seed germination is a common phenomenon at sub-optimal temperatures which causes a great concern for growers that grow this crop at early spring in cool regions of Iran. Delayed and reduced germination and seedling emergence cause non-uniform stand establishment and tender seedling subjected to soil-borne pathogens for long time. Seed maturation stage is an influential factor on germination performance in response to priming [28,1986;9]. In general, mature seeds tend to show better germination than those of earlier and later harvests, while advancement obtained by priming is greater in earlier harvests (premature seeds). Priming is also a valuable process for improving germination and uniformity of heterogeneously matured seed lots [28]. Seed priming is a presowing seed treatment that improves seed performance by increasing germination rate and uniformity. Priming exposes seeds to imbibition in low external water potentials that allows seed partial hydration [6].

Seed priming may also increase the seed or seedling tolerance to stress. Priming initiates metabolic activities, such as protein, RNA, and DNA synthesis, DNA replication, and b-tubulin accumulation [25].

Recently, it has been suggested that priming could enhance the activity of antioxidative systems, resulting in lower rate of lipid peroxidation, contributing to seed invigoration [3,38].

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When seed is allowed to imbibe, the rapidly increasing respiratory activities elevate free radical production, resulting in oxidative stress to cellular components [25,4]. Harris *et al.* [18] have also reported that overnight priming of seeds with water promoted seedling vigour, yield, and crop establishment of chickpea, maize (*Zea mays*), and rice (*Oryza sativa*). Seed priming is a technique of seed enhancements that improves germination or seedling growth. Seed priming enhances seed performance by rapid and uniform germination, normal and vigourous seedlings, which resulted in faster and better germination in different crops [8]. It permits seedling development in a wide range of agro-climatic conditions and decreases sensitivity to external factors [1,39]. Seeds performance of various crops can be improved by inclusion of plant growth regulators and hormones during priming and other pre-sowing treatments [24]. Priming is responsible to repair the age related cellular and sub cellular damage of low vigour seeds that may accumulate during seed development [7]. Priming of seed promotes germination by repair of the damaged proteins, RNA and DNA [22]. The conditions during seed priming and during subsequent germination and emergence were investigated as potential causes of variable seedling emergence relative to that of untreated seeds. Priming advanced emergence from moist sand cores at 30ºc /20º c (day /night), reduced emergence at 35 ºc/28 ºc and delayed and reduced emergence at 40ºc/28ºc, priming advanced germination time and did not decrease final percentage emergence [11]. This study was conducted to examine the Influence of thermo priming on germination of cowpea (*Vigna sinensis* L.) seed's.

Materials and methods

In order to determine the effect of thermo priming on germination in cowpea seed's, an experiment was conducted in 2011 at Laboratory Sciences, Islamic Azad University Shahr-e-Qods Branch by a completely randomized design with three replications and the first, seed viability was determined by Tetrazolium test method. The factors studied included different time thermo priming (0, 10 and 20 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 $25 \pm 1^{\circ C}$ for 8 days. Germination percentage was recorded after the 8th day. Germination percentage was calculated with the following formula:

Germination percentage = Number of germinated seeds/ Number of total seeds × 100

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

Seedling vigour index = Germination percentage × Seedling dry weight

Statistical Analysis:

Data analyses were performed using the Spss statistical software (Version 16). Mean separations were performed by Duncan's multiple range test (DMRT) at 5% level.

Results and discusion

The results showed that the effect of thermo priming was significant on germination in $P \leq 0.01$. The highest germination percentage, seedling dry weight, seedling vigour and seedling length were achieved by 10 minutes thermo priming (Table1, Fig1, 2, 3 and 4) and lowest germination percentage, seedling dry weight, seedling vigour and seedling length were achieved by 20 minutes thermo priming (Table1, Fig1, 2, 3 and 4). Priming enhanced germination, better establishment and increased yields in a range of crops in many diverse environments [30]. The priming technique due to its simplicity might be acceptable to the farmer of area as accepted to farmer in other semi arid region and promoted to a wide range of crops, for example maize [15] wheat [16] mung bean [29] Chick pea [26] upland rice in India [17] and millet in India [23]. It has been long known that one of the main merits of priming treatments is to increase germination and emergence rate [19]. However, the question arises whether rapid radicle protrusion is always reflected in rapid seedling emergence. Halmer and Bewley [13] proposed that emergence losses in the soil are not generally due to germination failure, but failure of seedlings to grow and emerge above soil surface. Rivas *et al.* [31] who observed earlier germination of primed Jalapeno pepper seeds. Increased emergence rate due to seed priming may be due to increased rate of cell division in the root tips of seedlings from primed seeds as reported in tomato [10]. Increased shoot and root length may be due to early emergence induced by priming treatment as compared to un-primed seeds. Stofella *et al.* [35] presented the same results by observing that priming of the pepper seeds significantly improved root length. Stress tolerance due to pre-treatment of seeds suggests that these molecules trigger the expression of the potential to tolerate stress rather than having any direct effect as a protectant [33].

It is well established that a vigourous seed can produce a better seedling under stress conditions than the non-vigourous one.

All the priming treatments showed improved germination as compared to non-primed seeds which was due to increased shoot and root length of seedlings from primed seeds and so much more vigourous than from un-primed seeds. Farooq *et al.* [10] also suggested that priming treatments improves the vigour of the seeds. Primed seeds usually exhibit the increased germination rate, reduced mean germination time, greater germination uniformity and some time greater total germination percentage in many plant species [20,14].

These were consistent with the Ruan *et al.* [32] findings on rice seedling establishment in flooded soil and Hampton and TeKrony's [37] view that high vigour seed lot would perform better in field performance under environmentally stressed seed bed conditions than low-vigour seed lots.

Primed seeds might have better plasma membrane structure by slow hydration [20]. Priming also causes to reduce the adherence of seed coat due to imbibition, which may permit to emerge out redicle without resistance as Nascimento and West [27] reported that the priming minimizes seed coat adherence during emergence of muskmelon seeds. Rapid embryo growth resulted when the obstacle to germination was removed [21]. These changes include macromolecular synthesis, several enzyme activities, increase in germinating power and vigour and overcoming of dormancy [21]. Generally, seed storage caused a decrease in the protein content, which may be related to oxidation of the amino acids, due to the increase in the respiratory activity and advance in the deterioration process of the stored seeds. Thus, prolonged seed storage would increase the metabolic activity of the seeds and consequently decrease the reserve substance content and reduce the dry material weight of the seeds [5].

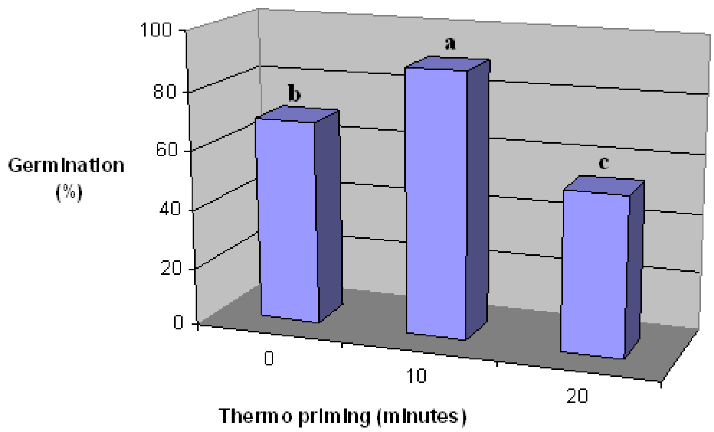

Fig. 1: Effect of thermo priming on germination percentage in cowpea.

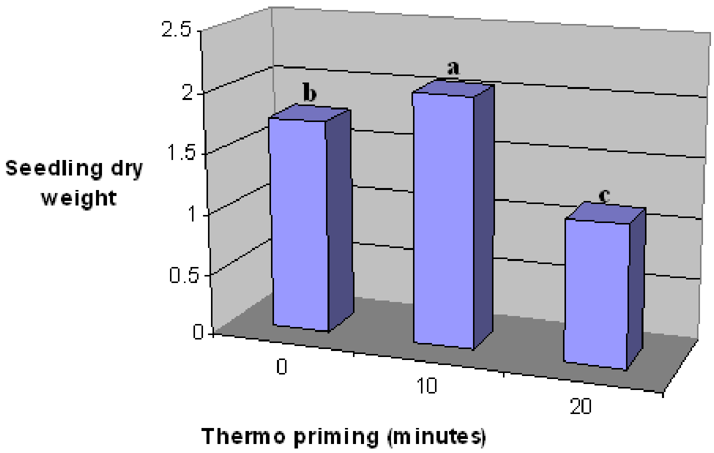

Fig. 2: Effect of thermo priming on seedling dry weigh in cowpea.

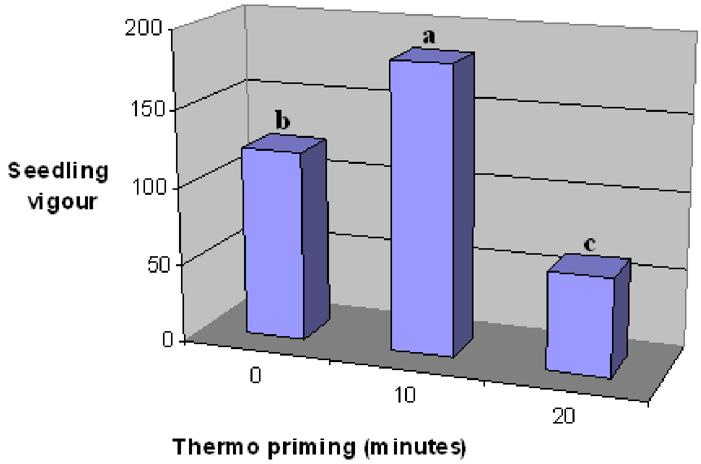

Fig. 3: Effect of thermo priming on seedling vigour in cowpea.

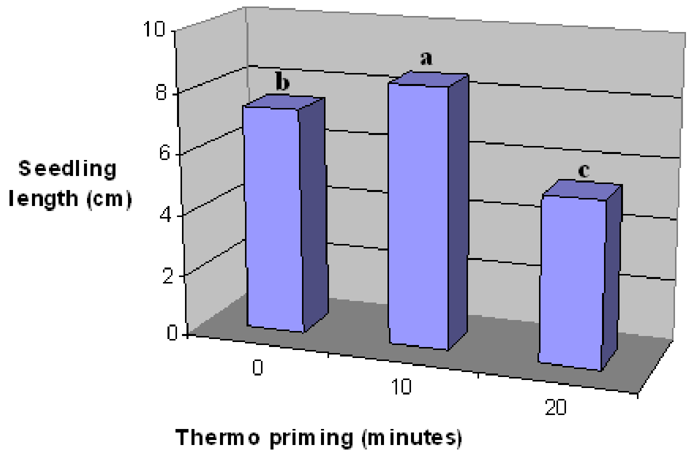

Fig. 4: Effect of thermo priming on seedling length in cowpea.

Table1: Means Comparison.

Heat priming (Minutes)	Germination percentage	Seedling dry weight(gr)	Seedling vigour	Seedling length (cm)
0	69.33b	1.76b	122.02b	7.43b
10	90a	2.05a	184.50a	8.51a
20	54c	1.16c	62.64c	5.41c

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

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