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ORIGINAL ARTICLE

Effect of Seed Size on Germination Percentage in Green Gram (Vigna Radiata L.)

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Hossein Aliabadi Farahani, Payam Moaveni and Kasra Maroufi: Effect of Seed Size on Germination Percentage in Green Gram (Vigna Radiata L.)

ABSTRACT

In order to determine the effect of seed size (small, medium and large) on germination percentage in green gram (*Vigna radiata* L.), an experiment was conducted in 2011 at Plant Physiology Laboratory, 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 results showed that the effect of seed size was significant on germination percentage and seedling dry weight in $P \leq 0.01$. Also, the results showed that the effect of seed size was significant on seedling length in $P \leq 0.05$. But the results showed that the effect of seed size was non-significant on seedling vigour. Mean comparison showed that the highest germination percentage (94 %), seedling dry weight (0.53 gr), seedling vigour (49.82) and seedling length (14.13 cm) were achieved came up to large seeds.

Key words: Seed size, germination percentage, seedling dry weight, seedling length and green gram.

Introduction

Green gram (*Vigna radiata* L.) is a wellknown ulse crop of Iran. It is a short duration crop and an be grown twice in a year. Being drought resistant, it can ithstand adverse environmental onditions, and is uccessfully cultivated in rainfed areas. Green gram is igestible, high in protein (22 - 24%;) [27] and does not cause flatulence that many other legumes do. Moreover, it is rich in vitamins as A, B, C, niacin, and minerals such as potassium, phosphorus and calcium, which are necessary for human body [38]. Owing to all these characteristics it is a good substitute of animal protein and forms a balanced diet when it is taken with cereals. Seedlings are the most sensitive stage in a plant's life history to environmental conditions. The ambient temperature during periods of soil water availability is known to be an important cue for seed germination, and the interaction effects of temperature and moisture availability at seed germination substantially contribute to promoting germination during conditions that enhance the survival of the seedling stage [47,4,32]. Life history strategies, including seed germination cues, may be shaped by natural selection, and the distribution of alternative strategies between species along life history trait gradients is considered to be an adaptive solution to maximize fitness under different environmental conditions [40]. Life history strategies also influence the allocation of resources by a parent to the size and number of offspring it produces [26,15]. This reproductive allocation is theorized to represent a trade-off in quantity versus quality of offspring, and in plants is thought to be characterized in the size versus number of seeds produced by the plant (Smith and Fretwell, 1974;41]. Large seeds have been demonstrated to have a competitive advantage over smaller seeds by having higher germination rates and having greater nutrient reserves for the young seedlings, which enable the seedlings to grow larger to tap resources earlier than their small-seeded counterparts [14,28,45, 32,48].

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Seedlings from large-seeded species should be able to establish under a wider range of environmental conditions that could not be tolerated by seedlings from small-seeded species [3,41,51,30, 16]. A problem when studying seed size and number theories is the definition of large and small seeds. Large seeds are generally identified as seeds whose larger size is the result of containing extra nutrient reserves for the growth of the resultant seedlings, and not by an absolute numerical interval [43]. Quality seed plays an important role in germination and seedling vigour and ultimately grain yield. The size of seed can influence the growth of maize. Large seed having more indigenous food reserve are capable to produce vigorous plant [13].

Small seeds although capable of germination do not seem to be as vigorous as large seed nor do they maintain viability in storage as well. Moreover, the presence of small seeds seems to reduce the apparent value of a seed lot [10]. Small seed size is related to persistence because small seeds are more likely to become buried [36,46] are less likely to be eaten [21] and can only emerge from shallow soil depths [6]. Furthermore, a rounded shape increases the probability of burial [46]. In a study of temperate herbaceous species, Milberg *et al.*, [33] showed that the influence of light on germination is much stronger in smaller-seeded than in larger-seeded species. Consequently, they suggested that a light response and seed mass co-evolved as an adaptation to ensure smallseeded species germinate only when close to the soil surface. Similarly, a study on seeds of neotropical pioneer species has also found strong dependence on the light response in smaller-seeded species, and a lack of such dependence in larger-seeded species [35]. Seedlings from small seeds have higher mortality than those from large seeds when subjected to various hazards including herbivory, water and nutrient stress [24,8]. This study was conducted to examine the Influence of seed size on germination percentage in green gram (*Vigna radiata* L.) seed's.

Materials and methods

In order to determine the effect of seed size (small, medium and large) on germination percentage in green gram 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. 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 9 days. Germination percentage was recorded after the 9th 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 = 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 discussion

The results showed that the effect of seed size was significant on germination percentage and seedling dry weight in $P \leq 0.01$ (Table1, Fig 1, 2). Also, the results showed that the effect of seed size was significant on seedling length in $P \leq 0.05$ (Table1, Fig 4). But the results showed that the effect of seed size was non-significant on seedling vigour (Table1, Fig 3). The highest germination percentage, seedling dry weight, seedling vigour and seedling length were achieved by large seeds. Also, the germination percentage, seedling dry weight, seedling vigour and seedling length increased by increasing size. Saranga *et al*. [42] found higher mean germination time in large seeds compared to small seeds. Saranga *et al*. [42] emphasized that thicker and heavier pericarp of large seeds may explain the slower rate of germination relative to small seed. Also, Reuzeau *et al*. [39] stated that lipid concentration was higher in small seeds with high germinability than in big seeds which were poor germinator. These results contrast with other studies showing that, within a plant species, rodents [20] and insects [12,34] select certain size classes of seeds to exploit likely based on the amount of energy they offer. Other studies have pointed out a positive relationship between seed size and germination success [44,22], while seedling vigor has been show to be especially important in determining the success of seedlings under competitive conditions [44,11]. Therefore, seed size may be an important factor determining which individuals succeed in the high density patches of seedlings that one may find in the forest understory [29,37].

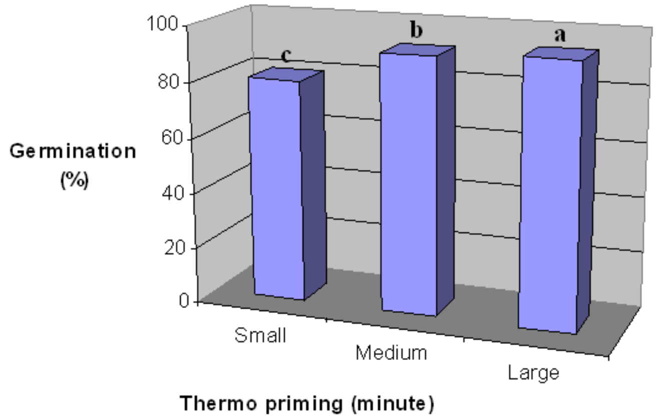

Fig. 1: Effect of seed size on germination percentage in green gram.

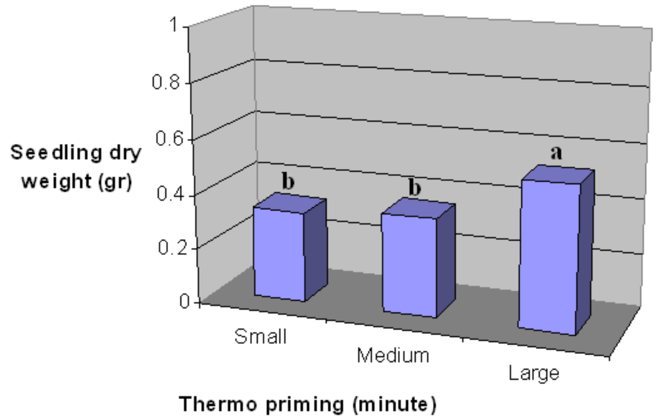

Fig. 2: Effect of seed size on seedling dry weight in green gram.

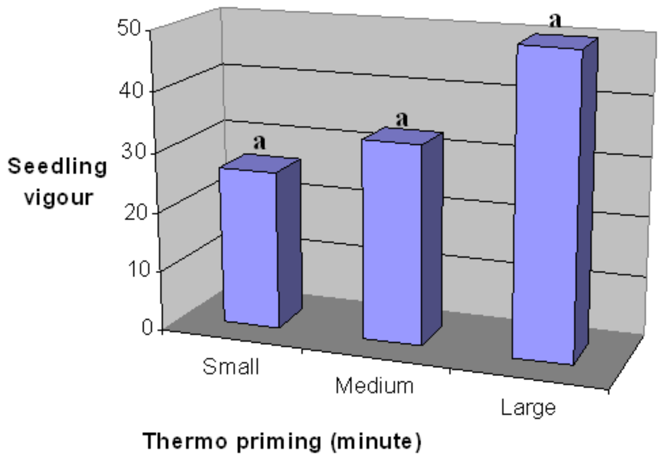

Fig. 3: Effect of seed size on seedling vigour in green gram.

Table1: Means Comparison

Treatment (seed size)	Germination percentage	Stem dry weight (gr)	Seedling vigour	Seedling length (cm)
Small	80c	0.33b	26.40a	9.93b
Medium	92b	0.36b	33.12a	11.60b
Large	94a	0.53a	49.82a	14.13a

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

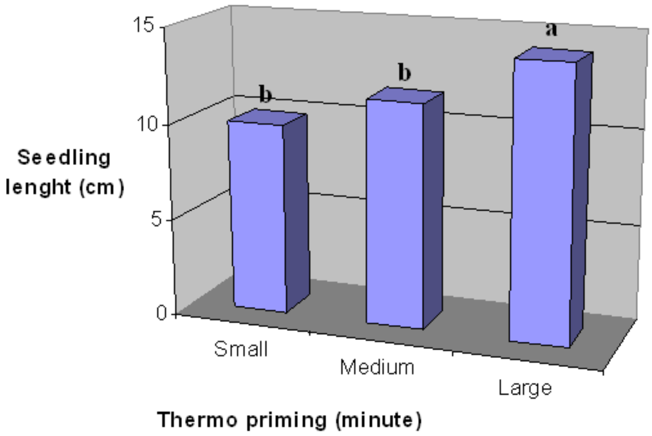

Fig. 4: Effect of seed size on seedling length in green gram.

Seedlings emerging from larger seeds may enjoy a lot of food supply from the larger cotyledons of their seeds than those from small seeds [2]. However as soon as seedlings from both seed sizes start to photosynthesise, the favourable effect of large size seeds with larger cotyledons would have been diminished [9]. Under normal condition and in moderate stress condition, higher germination percentage in large seeds may have little advantage compared to other seed sizes due to little differences in germination percentage. Under extreme stress conditions, larger seeds in triticale may have higher benefits in germination compared to smaller seeds. Therefore, higher germination percentage from larger seeds may be beneficial in establishing plants under dry soil conditions [31]. Willenborg *et al.* [50] reported that large oat seeds had greater final germination that resulted in better stand establishment, particularly where low spring soil moisture limits stand establishment than that of small seeds. Therefore, larger seeds had an advantage of seedling establishment in low soil moisture condition due to larger root system [24]. Roots play an important role in plant survival during periods of drought [87] and also drought resistance is characterized by an extensive root growth and small reduction of shoot growth in drought stressed conditions [17]. Moreover, Westoby *et al.* [49] reported that seedlings of larger-seeded species were better able to survive drought. Camacho and Caraballo [7] reported that root dry weight was identified as the major criterion for selection of maize genotypes under drought conditions. Therefore, large seeds may alleviate the negative effects of drought stress on seedling. Al-Karaki [1] reported that lentil seedlings from large seeds had higher shoot dry matter than those from small seeds. Moreover, large kernel weight was considered as a possible characteristic that may improve the drought resistance of short-duration pigeonpea in another study [25].

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