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ORIGINAL ARTICLE

Effect of Seed Size on Seedling Production in Wheat (*Triticum aestivum* L.)

[1]Hossein Aliabadi Farahani, [2]Payam Moaveni and [1]Kasra Maroufi

[1]Member of Young Researchers Club, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.
[2]Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.

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ABSTRACT

In plants encouraged by the proliferation of seed, seed to plant survival factor to maintain the role is very vital and important. In order to evaluate different size effect's on the quality seedling production during germination in wheat (*Triticum aestivum L.*), this 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 size of wheat seed (small, medium and large). The results showed that the effect of seed size was significant on germination percentage, seedling dry weight and seedling vigour in $P \leq 0.05$. Mean comparison showed that the highest germination percentage (97 %), seedling dry weight (1.09 g), seedling vigour (105.73), and seedling length (13.05) were achieved came up to large seeds.

Key words: Seed size, seedling vigour, germination percentage, seedling dry weight and wheat

Introduction

Cereals are a major source of dietary protein for humans. The mean annual production in the world (2001-2005) of all cereals exceeded 2100 million tones [38]. Cereal grains, wheat in particular, are among the most important crops globally. Wheat is most important among cereal crops in terms of area and production and is a staple food for more than one third of the world's population. Seeds of some plant species loose viability faster than others and there may be varietal responses within species. Wheat is very important crop all over the world and especially in Iran it has also got the status of economic and political crop. Wheat contributes more calories and protein to the world's diet than any other food crop [14]. Seed size and protein content have been shown to be related to seedling vigour[30,22,23]. Weimarck [43] reported that large seeds germinated better than medium and small seeds, and seedlings from large seeds had a higher survival rate than smaller seeds under field conditions. Moreover, seed size is positively correlated with seed vigour, and larger seeds tend to produce more vigorous seedlings [31]. As generally known, the most important stage in seedling development is the germination phenomenon, which leads at normal conditions in the further development of plants to high yield and quality. This process starts with the absorption of water, continues with radicle emergence and terminates with successful crop production [47,2]. The effect of seed size on germination and following seedling emergence have been investigated by many researchers in various crop species/ cultivar [26,19,17,32,12,20,47,17]. However, these results varied widely between species. With increased seed size higher germination and emergence were determined in pearl millet [18] and in triticale [18], but besides higher germination percentage declined median germination time were determined in some forage plants [20]. Moreover, many studies indicated that germination percentage of

Corresponding Author
Kasra Maroufi, Member of Young Researchers Club, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran
Email: kasramaroufi@yahoo.com

winter wheat [27], seedling emergence of soybean [16,41] and barley [8] were not affected by seed size. Singh *et al*. [37] reported that large seeds of soybean had greater supply of stored energy to support early seedling growth and subsequently affected plant growth and development. However, seed size has been considered to be a significant factor only during the early stage of plant growth. Nevertheless, Amin [3] reported that 50% of large-seeded mungbean matured earlier than that of small-seeded type. Although large seed has an advantage of having higher stored energy supply but not all reports demonstrated the effects of seed size on yield. Although the largest seed sizes have the largest cotyledonary area, the higher photosynthetic rate from smaller seed size could compensate and support seedling growth [6]. Several studies reported that seed size of difference of sorghum [39], soybean [35] did not affect yield of these crops. Suh *et al*. [39] explained that the source of the different in seed size and seed weight on the resulting crop was not affected by genetic and quality difference.

Materials and methods

In order to determine the effect of seed size (small, medium and large) on germination in wheat 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 ± 1°C for 7 days. Germination percentage was recorded after the 7th 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 discusion

The results showed that the effect of seed size was significant on germination in $P \leq 0.05$. The germination percentage, seedling dry weight, seedling vigour, and seedling length increased by increasing in seed size (Table1). Also, highest germination percentage, seedling dry weight, seedling vigour and seedling length were achieved by large seed (Fig 1, 2, 3 and 4). In the field, seed size had no effect on speed of emergence. These reports explained that larger endosperm enhanced emergence ability and large seeds of soybean had greater supply of stored energy to support early seedling growth and consequently its plant status [37]. Although genetic background of each variety was the main factor which influenced seed vigour in the field, seed size was a major factor which played an important role in affecting seed vigour in the laboratory. Reports on the effect of seed size on germination, field emergence, productivity and variations in crop stand in groundnut are available in the literature [36,9]. Also, several studies have reported an early advantage of seedling emergence and vigour [27,20] from large seed sizes, but few have shown that translated into final yield (Royo *et al.,* 2006). Grain yield advantages of 4.2% in bread wheat [7] and 16% in durum wheat [33] have been reported from large seeds over small sized ones. Royo *et al*. [33] also found that larger seeds resulted in high biomass, green area index, number of spikes per m^2 and heavier kernels. According to Manga and Yadav [24], seed size was found to be significantly influencing early vigour production. Furthermore, in barley (*Hordeum vulgare* L.), Turk and Tawaha [42] and in pinto bean (*Phaseolus vulgaris* L.), Gholami *et al.* [10] observed increased germination percentage as well as greater speed of germination in large seed compared with small, however, these results are inconsistent with those of Mian and Nafziger [26] who reported that seed size had no effect on germination characteristics in wheat. Small-seeded genotypes are probably physiologically most efficient, especially at warmer sites and higher latitudes [46]. An alternative explanation that seed size influenced growth and yield was that there may be a correlation between cell size in the seed and the cell size in the rest of the plant tissue [45]. Kaydan and Yağmur [28] pointed out that large seed with higher germination percentage in normal and stress condition may be related to privileged water uptakes. Al-Karaki [1] also reported that large lentil seed had higher water potential compared to small seed in low water potentials. Under extreme stress conditions, large seed may have higher benefits in germination compared to small seed. Higher germination percentage from large seed may be beneficial in establishing plants under dry soil conditions [27].

Table 1: Means Comparison.

Treatment (Seed size)	Germination percentage	Seedling dry weight(gr)	Seedling vigour	Seedling length
Small	90.3b	0.38a	34.3b	8.91b
Medium	95b	0.94a	90.24b	10.26ab
Large	97a	1.09a	105.73a	13.05a

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

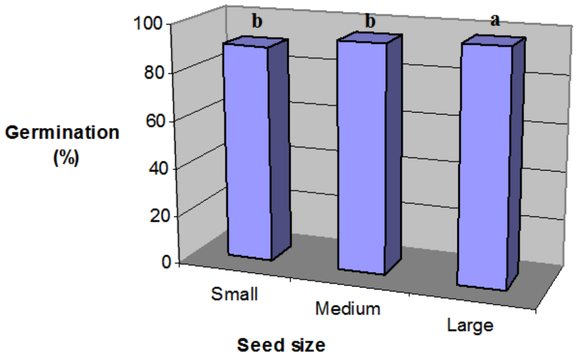

Fig. 1: Effect of seed size on germination percentage in wheat.

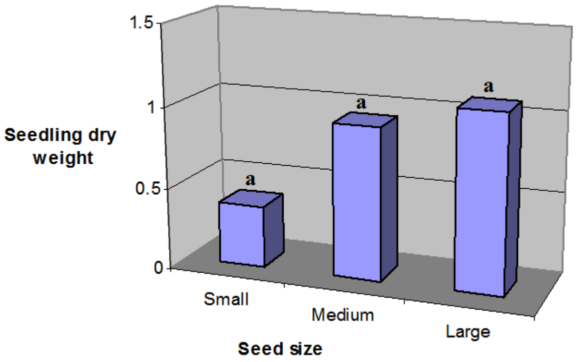

Fig. 2: Effect of seed size on seedling dry weigh in wheat.

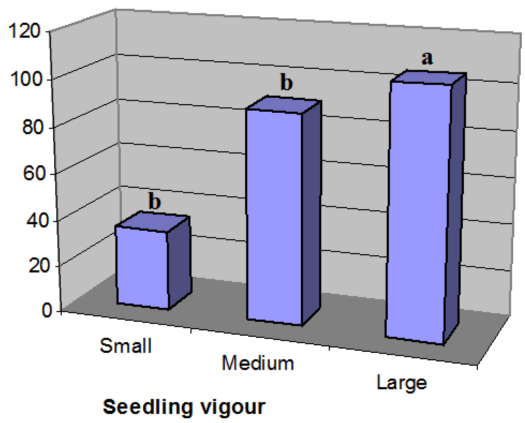

Fig. 3: Effect of seed size on seedling vigour in wheat.

The advantages of large seeds may be better expressed in moisture-stress environments, where planting depths also play a role [11,27,24]. Willenborg *et al.* [47] 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. Briggs and Dunn [5] indicated that germination characteristics differed significantly among a diverse range of western Canadian six-row barley. Al-Karaki [1] showed that lentil seedlings from large seeds had higher root length than those from small seeds at intermediate soil water potential. Similarly, Kaydan and Yağmur [18] indicated that reduction in root and shoot length of variety Presto in Triticale was lower in large seeds than those of

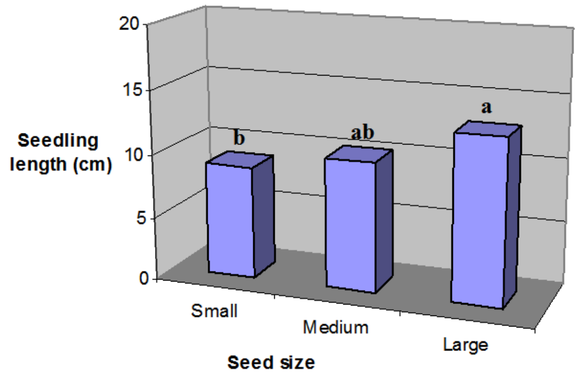

Fig. 4: Effect of seed size on seedling length in wheat.

small seed under control and water stress conditions. Hence, large seeds had an advantage of seedling establishment in low soil moisture condition due to larger root system [21]. Roots play an important role in plant survival during periods of drought [15] and also drought resistance is characterized by an extensive root growth and small reduction of shoot growth in drought stressed conditions [13]. Moreover, Westoby *et al.* [44] reported that seedlings of larger-seeded species were better able to survive drought.

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