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Results of Studies of the Effect of the Seed Fraction on Wheat Field Germination

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ABSTRACT

Seed size is important indicator of the seed quality and it is one of the indicators, which is related to the seed yield and crop and which expresses effectiveness of cultivation. The size of the seed and its shape have an important effect on the crop yield. Hence, we fractioned the variety Darkhan-144 seed with a sieve (2.0-2.2, 2.2-2.5, 2.5-2.8, 2.8<mm) and conducted field and laboratory analyses in order to identify the effect of seed size to some indicators of the seed quality.Experiment was conducted with randomly plot selection method and 3 replication. According to the 2-years results, crop of the large-sized seeds was practically better. When we cultivated large-sized seeds byindicators of yield components of wheat, such indicators as plant number per m2, number of productive tillering, and grain number per spike were increased. According to the study results, it is suitable to use large-sized seeds in order to increase field germination and yield. Seeds become smaller due to drought and hot, so cultivating seeds with diameter less than 2.2mm showed reduction of field germination and so yield decrease.

Keywords: *Triticum aestimum, seed size, yield, seedling emergence*

INTRODUCTION

As generally known, among producing factors, seed as the first consumer store, plays an important role in the transfer of genetic characters and improvement of qualitative and quantative traits of production. One of the most important factors in maximiznig crop yields is planting high guality seed. Seed size is an important physical indicators of seed quality that affects vegetative growth and is frequently related to yield, market grade factors and harvest efficiency [1]. Effect of seed size (less than 1.95, 1.95-2.35 and more than 2.35 mm) on germination characteristics of six oat (Avena sativa L.) cultivars under water stress condition were showed that germination was increased with increasing seed size in oat cultivars [2]. Result of a study showed that higher vigor that occurred in larger seed due to the larger food reserves it these seeds [3]. Poor germination comes out of the seeds with less resources in endosperm; as well it is strongly vulnerable to drought, hot and unfavorable conditions, which is the reason for crop decrease.

Seed size is one of the components of seed quality which affect the performance of crop (Oja, 2000; Adbisi 2004; Adebsi et al., 2011). Seed germinations one of the most important phase effecting yield and quality in crop production (Almansouri et al.,2001). The effect of seed size on germination and following seedling emergence have been investigated by many researcher in various crop species/cultivar (Lafond and Baker, 1986; Kawade et al., 1987; Roy et al., 1996; Gubaerac et al., 1998; Larsen and Andreasen, 2004; Willonborg et al., 2005; Kaydan and Yagmur, 2008). The study prupose to establish seed quality and crop dependence under the current ecologic and climate changes, identify possibilities to overcome the negative climatic impacts, and to increase crop farming production.

METHOD

Location of the experimental plantation: Research work was conducted on the experimental field of the wheat selection sector of IPAS between 2015-2016. The experimental field of the selection sector is located in the Burkhant valley in the Kharaa river basin with geographical coordination of $49^0 28$ southern latitude and $105^0 54$ longitude, 70.5 meters above the sea level, 3 km far from the center of Darkhan-Uul province. Field soil is light sandy, brown type.

Seeds from registered grade were cleaned in the selector of Agriculture faculty, and four different sieves (2.0-2.2 mm, 2.2-2.5 mm, 2.5-2.8 mm, 2.8<) of the machine of EML200 models were used to separate the seeds. The seeding rate was adjusted for density of 350 seeds m^{-2} for all seed size applications, according to standard practices. Experiment was conducted with randomized selection method and 3 replication. The experiments were sown by seed hand planting in 15 May 2015 than 2016. Plot size was six rows, 1 m long, with 15 cm between rows. Grain yield was determined on the basis of the harvested plot in all trials. Test weight, measured in a sample of one tons per plot, is expressed as t\ha. Data analysis was performed using software (SPSS 25) in the study.

RESULT

Analysis of variance showed highly significant variation among the four different seed size application for seedling emergence, number of plant $1m^2$ field, number of seed ni per head, 1000 kernel weight, spikelet number, seed weight of per head and grain yield. However, significant variation was not number of productive tillering (Table 2).Analysis of variance showed highly significant variation among the four different seed size application for seedling emergence, number of plant $1m^2$ field, *Number of productive tiller*, spikelet number, and grain yield. Seedling emergence valus were realized as follow:56.9-65.6% m^{-2} (first year), 70.5 to 78.6% m^{-2} (second year) and 63.8 to 73.1 m^{-2} (average of the years).Although the highest seedling emergence values for the first year, second year and average of them were observed from the biggest-seize (>2.5 mm) seeds, the lowest values were obtained from the smallest-sized (<2.2) seeds (Table 3).

Number of plant $1m^2$ field fraction groups showed significant differences for first year (117 to 133), second year (185 to 218) and average of them (124 to 198.5). According to the years and average of the years, the minimum number of plant periods were obtained from the smallest-size seeds (<2.2 mm). Other seed groups showed number of plant (Table 4). By number of productive tiller, it fluctuated between 180-240 in first year, 299-376 next year and on average 239-308. Number of productive stems varied depending on the climatic condition of current year. By quantitative data 2.8 mm fraction has practical results.

In this research, statistically different groups were found among seed sizes for thousand kernel weight (TKW) in first year and as average of the years. Values of TKW ranged as follows: 30.8-33.5 g (first year), 37.7-39.3 g (second year) and 34.4-36.4 g (average of the year). According to the second year and average of the year, there were statistically non-significant differences between seed size group: According to the first years, there were statistically significant differences between seed fraction group: plot which had 2.8 mm seed size were at the first year with highest TKW values(Table 4).

Grain number per spike fraction groups showed significant differences for first year (29 to 34), second year (35.7-40.5) and average of them (32.3-37.2).By number of seeds per spike, 2.5mm fraction variant had practical effect but 2.2 mm fraction had the least grain number.

By number of seeds per spike, it fluctuates between 0.80-1.10 g in first year, 1.3-1.4 next year and on average between 1.0-1.2 g. By number of seeds per spike, fractions above 2.2 mm had practical effects.

Seed size showed differences except the first year for grain yield. Grain yield means ranged as follows : 0.8 to 1.1 t\ha (first year), 2.2 to 2.7 t\ha (second year) and 1.5 to 1.9 t\ha (average of the years). In both years and the average of the years, highest grain yield means were obtained from seed size with 2.8 mm diameter, but showed lowest 2.0-2.2mm grain yield values (Table 4).

Table1. *Indicators of climate of the study year, 2015-2016*

Year	Rainfull, mm						Temperature (^{0}C)				
	May	June	July	August	Sep	Total	May	June	July	August	Sep
2015	21.7	12.2	25.2	171.2	49.6	279.9	10.8	19.3	24.0	20.8	11.7
2016	14.6	125.3	68.1	55.1	32.8	295.9	11.7	18.3	21.9	18.4	12.7
Average	**26.5**	**57.2**	70.8	87.9	**38.1**	**280.5**	**12.1**	18.4	**20.8**	**18.1**	11.2

**25 years averages.*

Table2. *Analysis of variance of investigated characteristics in wheat at different seed size*

	Mean squares

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	Seedling emergence, %	Number of plant 1m^2 field	Number of productive tillering	Thousand grain weight (g)	Grain number per spike	Grain weight per spike (g)	Grain yield t\ha
Year	65.4*	197506.1 **	625891.9* *	1249.0**	1593.3**	6.2**	10651.9**
Seed size (S)	101.9**	4272.4**	31245.8**	35.395	178.6**	0.235**	347.1**
S*Year	55.7	1558.9	896.9	2.5	3.6	0.073*	97.1***
CV%	13.3	13.6	14.6	9.1	10.4	14.4	26.1

**, ** Significant at the 0.05 and 0.01 probability levels, respectively*

Table3. *Determination of seed viability rate and field germination*

Seed size, mm	Seedling emergence ,%		Average
	2015	2016	
2-2.2	56.9b	70.5b	63.8b
2.2-2.5	57.1b	71.4b	64.2b
2.5-2.8	63.8a	77.4a	70.6a
2.8<	65.6a	78.6a	73.1a
mean	60.8	74.4	67.9
$LSD_{0.05}$	0.24	0.07	0.15

Means within a column followed by the same letters are significantly at P=0.05

Table4. *Yield and yield components, 2015-2016*

Seed size, mm	Number of plant 1m^2 field		Number of productive tillering		Thousand grain weight (g)		Grain number per spike		Grain weight per spike (g)		Grain yield t\ha	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
2-2.2	117b	185b	180b	299c	30.8b	37.7a	29b	35.7b	0.80b	1.3	0.8b	2.2c
2.2-2.5	119b	186b	195b	324cb	31.0b	38.1a	31ab	36.4b	0.97a	1.3	0.9ab	2.4cb
2.5-2.8	128ab	203ab	211ab	354ab	31.5b	38.3a	32ab	38.6ab	0.97a	1.4	0.9ab	2.7ab
2.8<	133a	218a	240a	376a	33.5a	39.3a	34a	40.5a	1.10a	1.4	1.1a	2.8ab
mean	124	198.5	206	338.8	31.7	37.6	31.5	37.9	0.96	1.4	9.7	25.5
$LSD_{0.05}$	0.41	0.173	0.07	0.038	0.18	0.551	0.07	0.129	0.15	0.333	0.077	0.096

Means within a column followed by the same letters are not significantly different at P=0.05

DISCUSSION

Study results show that having strong and well-growed field germination with the suitable number to the soil and climatic conditions of our country is one of critical factors of the yield.

According to our study results the smallest seed by field germination for the 2 years mean is 63.8 mm but seeds >2.8 mm occupied 73.1%. According to wheat studies, germination of seeds eith diameter of 2.5-2.8 mm was 93.4%, which was the highest germination rate result. Moreover, germintaion of seeds with diameter 3.0-3.25 mm was 92.3% but germination of seeds with diameter 2.0-4.0 reduced to 90% [4].Likewise, we harvested maximum yield from the seeds of a large fraction. Likewise, we harvested maximum yield from the seeds of a large fraction.The lowest and highest seedling emergence percentage was occurred in smallest seed size (67.9%), and in 2.8-3.0 seed size (80.55%) respectively[5].For 2 years studies result showed that plant number per m^2, number of productive tiller, thousand grain weight (g), grain number per spike, grain weight per spike (g), grain yield t\ha and other indicators increased. The highest yield from >2.8 mm in 2015, but in 2016 from >2.5mm variants. Bigger seeds have severel advantages when compared to smaller seeds, such as faster seedling growth, higher number of fertile tillers per plant and higher grain yield [6]. Likewise, we harvested maximum yield from the seeds of a large fraction.The advantage of bigger seeds is demonstrated when the crop is growth under environmental stresses , particularly in drought

[8]. However, in the 2016 in which took sufficient preciptation for wheat growth (Table-1) the increased seed size resulted high grain yield. Also large seeds can be more resistant under heat and drought stress conditions than small Seeds. Result of some researchers clarified that seed size notably affected grain yield and grain yield components such as plant stand, plant height, seed weight and number of seeds per spike (Stougaard and Xue, 2004; Royo et al.,2006).

Conclusions

The larger seed produce more strong sprout and determine the viability of plant.

Wheat seed size had practical effect to the number of plants, productive stems, weight of seeds per spike, yield and others. Cultivating wheat seed with size above >2.2 mm is definitely an important factor in seed production.

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