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Evaluation of Different Bread Wheat (*Triticum aestivum* L.) Varieties for Seed Quality Analysis in South Eastern Ethiopia

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Abstract: Seeds are basic agricultural input and it has a unique feature for delivering technology to increase the production and productivity of the farmers. Due to poor seed quality, the production and productivity of the farmers was declined. Therefore the objective of the experiment was to evaluate different bread wheat varieties for the seed quality analysis. The experiment was laid out in randomized compete design with three replication in Sinana Agricultural Research center laboratory. Seed germination (%), purity percentage (%), Seed physical purity (%) and thousands seed weight (TSW)Root length, shoot length, Fresh weight, Vigor index I and Vigor Index II, were tested in the laboratory and the data were analysized using SAS 9.00 software to confirm whether all varieties fit minimum seed quality standard or not. The results indicated that the only seed purity were significant different and other Quality traits were non significant variation for other. The result of the study confirmed the mean square of all the varieties consists good seed quality due above minimum standard except only kind birds. Therefore all seed varieties were used for the next production.

Keywords: Bread Wheat, Seed Quality, Germination, Purity, Vigor Index

1. Introduction

Wheat (*Triticum spp*.) is one of the globally produced cereal crops which cover 15% of the total production area within the world. Wheat is grown on larger area than any other crop and its world trade is greater than for all other crops combined. Its world trade is greater than for all other crops combined. It is easily stored and transported [23]. It is the primary source for human nutrition [1, 11] and industrial grain traded internationally [7, 16].

Seeds are basic agricultural input and it has a unique feature for delivering technology to increase the production and productivity farmers. Seed quality, particularly its genetic attributes, determines the level of crop productivity in the presence of other crop-production inputs [8, 19]. Seed quality is very important to optimum growth and yield production in farm which influenced by many factors such as genetic characteristics, viability, germination percent, vigor, moisture content, storage conditions, survival ability and seed health [22]. Accessibility and availability of quality seed is the basis for food production, improved yields, and a source of crop and food variety since they respond to farmers needs for both their increasing productivity and crop uses [15, 19, 21].

The productivity of the wheat remains low (2.4 tons ha^{-1}) in the Ethiopia as compared to the world average yield 3.19 tons/ha [9]. Decline in yield was affected byfarmer seed saving (low seed quality), increased grain prices due to high demand, affecting seed availability and affordability [14]. If seed is poor in seed quality it will lead to lose seed as well as crop production totally [4-5]. Limited availability of and access to quality seed is regarded as one of the main obstacles to increasing crop productivity in Ethiopia [18]. In most cases, due to several reasons, farmers have no access to quality seed from suppliers, which forces them to use poor-quality seed and eventually obtain low production.

Germination potential seed is very crucial thing that determine good field emergence, best field performance and final productivity per unit area of land [17].

Different studies and reports show that shortage and inaccessibility of quality seed is one of the main problems for many crops which can be leads reduction of the crop production and productivity. Even if there are multi and interlinked factors described in many literatures, the main contributing factors that impose effects on quality seed and crop production are agronomic factors and physiological factors [12, 15, 25]. There is little information regarding to the effect of different bread wheat varieties on the seed quality analysis of the bread wheat in the study area. Therefore the objectives of the study to Evaluation of Different Bread Wheat (Triticumaestivum L.) Varieties for Seed Quality Analysis in Bale and Arsi, Ethiopia.

2. Material and Methods

2.1. Description Area and Sampling

The study was conducted belt area of wheat seed production of Bale zone (Sinana, Agarfa, Adaba and Goro) and West Arsi (Adabba and Dodola) Oromia National Regional State. The sample was being collected from different formal and informal seed producers. The seed quality analysis was done at Sinana Agriculture Research Center of seed laboratory.

2.2. Seed Sampling Procedure

One (1) kg of wheat seed sample was drawn from the different areas of seed producing area. Primary seed sample was collected from formal and an informal seed producer as well as Composite sample was done by mixing the primary sample collected from the seed producing cooperatives. From the composite sample the working sample was taken for the laboratory analysis. All tests was done according to procedures described the International Seed Testing Association (ISTA, 2004) rules, and tests outside tolerance limits will be repeated.

2.3. Experimental Design and Treatment

The experiment was laid out in Randomized Complete Design (RCD). It also consist 13 treatments with three replication collected from different locations.

2.4. Method of Data Collection

Seed quality Parameters

1) Seed purity test

Based on International Seed Testing Authority (ISTA, 2004), purity analysis of each 'pure' seed source 200 g samples was separate from 1 kg working samples sorted and categorized into four components including (i) pure seed, (ii) other crop seeds, (iii) inert matter and iv) weeds seed. The percentage of each fraction was recorded on a weight-by-weight basis and only the seed purity percentage was analyzed.

$$\text{Seed purity Percentage} == \frac{\text{Weight of pure seed (g)}}{\text{Total weight of sample (g)}} \times 100$$

2) Seed weight Thousand

Seed weight will determine by counting hundred seeds and weighing and multiply the weight (g) by ten to get a thousandseed weight. This will do five times to be counted (replicate) to get information that is more accurate from pure seed samples.

3) Standard Germination

Germination test was done according to ISTA (2004). For each treatment, 400 seeds were counted at random from the working seed sample. Then, 100 seeds were planted from each replication in sterilized sand media. The germinated seed were counted eight days, normal, abnormal and diseased seeds were sorted.

4) Seedling dry weight

The seedlings dry weight was measured after the final count on the standard germination test. Ten seedlings were randomly selected from each replication and cut free from their cotyledons weighed, and placed in an envelope, then dried in an oven at 80°C for 24 h (ISTA, 2004). The seedlings were dried and weighed to the nearest milligram and the average seedling dry weight was determined.

5) Vigor index-I

Vigor index-I is the percent germination x the sum average of shoot length and root length.

$$Vigorindex = Germinationpercentage * sumaverageofshootlenghandrootlength$$

6) Vigor index-Il

Vigor index-Il is the percent germination multiplied by the average seedling dry weight.

$$VigorindexII = Germinationpercentage * Averageofseedlingdryweight$$

2.5. Data Analysis

The statistical analysis for the laboratory tests will on a completely randomized design using R-software statistical package and the LSD will done if the treatments was significant different.

3. Result and Discussion

3.1. Effect of Different Varieties on the Purity Percentage, Hundred Seed Weight, Germination Percentage and Root Length

The analysis of variance indicated on the table 1 showed that different bread wheat varieties were significantly different ($p<0.05$) on thepuritypercentage, hundred seed weight and Germination percentage while the root length

were non significantly different among the variety. The maximum (96.10) purity percentage were recorded from the Dambal variety while minimum purity percentage were recorded from the kingbird variety (63.83%). The variety with high purity percentage contains small amount of inert matter, other crops, weeded seeds and infected seed while small amount of purity percentage indicates that the amount of inert matter, other crops, weeded seeds and infected seed is high. According to the research [6] the high quality purity percentage range was between 95 -98% were high purity percentage. The maximum hundred seed weights (4.70 g) were recorded from Kingbird variety but the minimum hundred seed weight (3.44 g) were recorded from the Dambal variety this due to the characteristics of genetic characteristics, the endosperm of the seed and seed size. According to the author [17] reports High thousand seeds weight will increase germination percentage, seedling emergence, tillerring, density, spike and yield. Thus seed weight or thousand grain weight has a large effect on seed germination, seed vigor, seedling emergency and yieldproduction.

Table 1. *Effect of different Varieties on the purity percentage, hundred seed weight, Germination percentage and Root length.*

Variety	Purity%	HSW	GR%	RL
Dambal	96.103	3.44	98	7.96
Sofumar	95.753	3.813	96.3	7.20
Galan	95.206	4.556	98	8.13
Dheqeba	91.07	4.46	90	7.96
Shorima	90.43	3.866	84	7.433
Wane	90.31	4.133	85	8.56
Danda'a	90.20	4.066	86.0	7.40
Mandoyu	89.85	3.263	96.3	7.66
Obora	89.11	3.49	97.3	8.166
Ogolcho	88.99	4.233	92	7.13
Lemu	88.84	3.80	86.3	8.10
Sanate	84.09	3.73	95	7.80
Kingbird	63.83	4.70	92	8.06
CV	3.40	5.63	3.10	12.49
LSD	5.07	0.37	0.048	Ns

HKW=Hundred seed Wight, GR= Germination Percentage, RL=Root Length

Analysis of variance indicated on the table 1 showedthat the germination percentage were significantly different among the bread wheat varieties collected from the seed producer. Maximum germination percentages (98%) were also recorded from the Galan and Dambal variety but the minimum germination percentage (84%) were recorded from the shorima variety this indicates that as germination rate and seedling vigour index values increased with the increase of seed size suggesting the selection of larger seeds for good stand establishment in wheat. In wheat, seed size is positively correlated with seed vigour, larger seeds tend to produce more vigorous seedlings [10]. Generally, bigger seeds germinate quicker and would take lesser duration when compare to that of smaller ones and has better field performance than small seed.

3.2. Effect of Different Bread Wheat Variety on the Shoot Length, Fresh Weight, Dry Weight, Vigor Index I and Vigor Index II

The analysis of variance indicated on the table 1 shows that the shoot length, Fresh weight, Vigor index I and vigor index II were significantly different among the variety while the dry weight ere non significant different among the variety. The longest shoot lengths (20.83 cm) were recorded from the Galan variety however the minimum shoot length (15.13cm) were recorded from the shorima variety. This indicated that the galan variety were high plant height than the other variety. It indicates that as the plant height increase the shoot length of the plant becomes increased while the shortest plant height contains the shortest plant height than the Galan variety. The highest the fresh weights (0.362 g) were recorded from the Sanatevariety and the lowest the fresh weight (0.143 g) were recorded from Lemu variety. The results indicates that the fresh weight were positive correlate to the biomass yield. If the fresh weight increased the biomass weight of the crop becomes increased. Similarly, the research [24] reported that large seed size produce higher seedling dry weight and it was noticed that seedling dry weight in large seed sizes was related to more seed food storage in their endosperms.

Table 2. *Effect of variety Bread wheat on the shoot length, fresh weight, dry weight, vigor I and Vigor II.*

Variety	SHL (cm)	FW (g)	VI	VII
Dambal	19.00	0.319	25.63	16.69
Sofumar	16.80	0.347	22.13	15.887
Galan	20.83	0.303	25.19	16.51
Dheqeba	18.00	0.3420	23.17	12.99
Shorima	15.13	0.176	19.05	15.934
Wane	16.80	0.156	21.91	13.537
Danda'a	16.33	0.280	20.89	13.037
Mandoyu	16.26	0.297	22.97	18.42
Obora	19.66	0.314	27.04	15.464
Ogolcho	15.46	0.300	19.99	12.64
Lemu	15.80	0.143	20.89	14.75
Sanate	16.96	0.362	23.94	15.07
Kingbird	20.00	0.276	26.48	13.767
CV	9.012	15.64	8.901	11.35
LSD	2.641	0.0731	3.439	2.853

SHL=shoot length, FW=fresh weight, DW=dry weight VI=vigor index I, VII=Vigor index II, CV=coefficient of variance, LSD=Least significant difference

The analysis of variance on the table 2 indicated that the different bread wheat varieties was significant different ($P<0.05$) among on vigor index I and Vigor index II. The highestvigor index I (26.48) were recorded from kingbird and the minimum vigor index I (19.05) were recorded from the Shorima variety while Maximumvigor index II (18.42) were recorded from the Mandoyu varieties and the minimum vigor index II (12.64) were recorded from the Ogolcho varieties. In wheat, the vigor index II was depending on the seed size of the variety. According to the research [20] report the low-vigor spring wheat seed produced lower crop stand and lower grain yields. Similarly, Basra, A. S.[2] reported

that practical seedvigor test should give a good indication of field performance potential of the seed lot and the test results should be reproducible.

4. Conclusion

The mean square for Seed inert matter and seed purity showed significant variation which indicate that all treatment needs equal management during assuring internal seed quality process.

Wheat (Triticumaestivum L.) is one of the most important world cereal crops and is a staple food for about one- third of the world's population. It is one of the cereal crops produced in southern Ethiopia where its production and productivity is low due to the use of poor quality seeds and field establishment. This indicates that the needs to conduct research and to evaluate the different bread wheat varieties for the seed quality are the most important seed quality to improve production and productivity of wheat. The study consisted of laboratory experiment of which laboratory experiment was conducted at Sinana Agricultural Research center Seedresearch Laboratory.

The results indicates that different bread wheat varieties were significant different on the seed quality. Planting high quality seed is the first step to growing a successful crop. High quality seed is important to ensure maximum seed germination and seedling vigor, which is turn is instrumental in achieving maximum yield. Poorer quality seeds show low viability, reduced germination and emergence rates, and poor tolerance to sub optimal conditions the seed quality is also reflected in the final growth, maturity of plants, and their uniformity. Generally the result from this study indicates that all the varieties fit minimum standard for the next seed production and to know more genetic potential of the varieties further molecular based investigation is required.

Conflicts of Interest

The authors declare no conflict of interest.

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