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Evaluation of Different Bread Wheat (*Triticum aestivum* L.) Varieties for Some Seed Quality Parameters at Kulumsa Agricultural Research, Ethiopia

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Abstract: Seed is the initial input and final out put in every crop production system. But every production could not generate seed because seed is a living entity that need maximum care and required a serious of management procedures to fit minimum quality standard. Bread wheat seed production is the leading crops tested by both abiotic and biotic factors which reduce seed quality. Kulumsa Agricultural seed researcher's team is yearly testing quality of their seeds both at field and laboratory. The present study was carried out on eight (8) breeder seeds and eight (8) pre-basic seeds total of 16 bread wheat treatment after cleaning by Using RCBD design under laboratory. Seed germination (%), Moisture content (%), Seed physical purity (%) and thousands seed weight (TSW) were the quality parameters. data collected were Subjected to Analysis of variances by using SAS 9.3 software to confirm all varieties fit minimum seed quality standard or not. Analysis of variance revealed that there is a significant variation among treatments for seed purity while no significant variation for other quality traits. The result of the study confirmed the mean square of all the varieties were above minimum standard which is guides the seed for next production the result from this study indicates that all the varieties fit minimum standard for the next seed production.

Keywords: Bread Wheat, Seed Quality, Germination, Purity, Thousand Seed Weight

1. Introduction

Wheat (*Triticum Aestivum* L.) is the most important crop among the major three cereal crops that provides 20% of total energy requirement in human diet [8]. Bread wheat (*Triticum aestivum* L.), with an annual global production of 772.6 million tons, is a staple food for more than 35% of the world's population [11]. Globally, China, India and Russia are the largest wheat producers, while South Africa and Ethiopia are the largest wheat producers in sub-Saharan Africa (SSA) [12]. Ethiopia ranks second in sub-Saharan Africa in total wheat area and production [1, 6]. 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 [8]. 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 [3].

Germination potential seed is very crucial thing that determine good field emergence, best field performance and final productivity per unit area of land. A small change in seed moisture content has a large effect on the storage life of the seeds. Therefore it is important to know the moisture content in order to make a reasonably accurate prediction of the possible storage life of each accession. Noor-mohammadi et al. [7] reported that the amount of Moisture content at which seed stored can affect the storability of bread wheat based on surrounding Relative humidity and temperature. Seed development and changes in germination potential and longevity of cereal crops like barley (Hordeum vulgare L.) and wheat (*Triticum aestivum* L.) are highly influenced by Moisture content [2]. Generally, factors such as genetic structure, environment and parental nutrition, maturity stage in harvest time, mechanical damages, seed storages, age and aging and pathogens, affect seed germination and vigor [4]. According to High thousand seeds weight will increase germination percent, seedling

emergence, tillerring, density, spike and yield [7]. Thus seed weight or thousand grain weight has a large effect on seed germination, seed vigor, seedling emergency and yield production. Gelata et al. (2015) reported Productivity and with different phenotypic traits of Bread wheat. Nedeva D, and Nicolova A. (1999) reported that after flowering and during grain filling period of wheat, decreased the moisture percent and increased the dry matter percent (dry grain weight) and germination percent [5]. Alamu D. et al. (2021) reported that rust suceptatablity and unstable condition of different bread wheat across different environments [13] which directly could result in poor seed quality. Geleta, N., & Grausgruber, H. [14] also report seed quality can affected by different rust. The main problem of recent Ethiopian Bread wheat variety is Poor quality seed with low germination, due to different abiotic and biotic factors like fungal disease occurring during field production.

This study were carried out on sixteen (16) bread wheat seeds of which eight (8) breeder and eight (8) were pre-basic of different varieties multiplied in the year 2020 main season for seed purposes. Internal Quality assurance is conducted annually to confirm the fitness of national and ISTA seed quality standard under Kulumsa Agricultural Seed laboratory.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted at Kulumsa Agricultural Research Center (KARC) from January, 2021 to February, 2021 under laboratory conditions. The site is located at 8°00' N and 39°07' E at an elevation of 2210 m above sea level in Arsi Administrative Zone of Oromiya Regional State, 167 km South East of Addis Ababa. The agro-climatic condition of the area is wet and receives a uni-modial mean annual rainfall of 809.15 mm from March to September; however, the peak season is from July to August. The maximum and minimum mean temperature is 23.08 and 9.9°C, respectively [10].

2.2. Materials and Experimental Design

Totally sixteen (16) treatments of Bread wheat seeds multiplied in 2020 was taken from storage soon after cleaning. Among these (16) varieties eight (8) of them were Breeder seeds while eight of (8) of them were pre-basic seed classes.

The sample size was taken from each lot according to ISTA 2020 Seed testing procedure to improve the representativeness of the working sample.

This experiment was conducted under seed laboratory using RCBD design having four replication. Working bench (table) served to replicate of activity during this work. After Submission of sample from each seed lots the seeds of the same verities from each lot were subjected to mixing and only reduced working sample taken to seed purity analysis room. Seed physical purity were conducted According to ISTA from homogenized 120g of seeds finally composition of seed were identified by % for each verities. Seeds were sown in Petri dishes on moistened absorbent paper (blotter) thick layers to provide enough moisture for germination period. The supplementary water was dropped on the 4th day it was count after 8 days of sown.

2.3. Data Collected

Seed purity: purity is the expressions of how clean the seed lot is. It is calculated as follow according to ISTA 2020.

$$\text{Purity seed (\%)} = \frac{\text{weight of pure seed(g)} * 100}{\text{Total weight of working sample (g)}}$$

Moisture Content (%): Seed moisture content is the most important attribute influencing seed quality and storability.

It was measured soon after cleaning by using Moisture tester adjusted for wheat crops.

Thousand seed Weight: is the weight in grams of 1000 seeds of wheat and may indicate grain size and internal composition of seeds. It was taken from working sample after mixing the submitted lot taken from each lot of the same variety and replicated for times for all varieties. Automatic seed counter was adjusted to 1000 and used for counting of the seed.

Germination: The normal germinated seed lings after 9 days of planting was calculated excluding Dead (un germinated seed) and Abnormal seed ling at final count then percentage is calculated as follows.

$$\text{Seed germination (\%)} = \frac{\text{Number of normal seed ling(\#)} * 100}{\text{Total Planted seeds (\#)}}$$

2.4. Data Analysis

The Collected data were homogenized thoroughly passed for Analysis using 9.3 software.

Analysis of variance and mean comparison among treatment were also carried out.

Table 1. *Analysis of variance (ANOVA) results.*

Quality parameters	Mean squares for Source of Variation			
	Rep (df=3)	Treatments (df=15)	Error (df=45)	Coff. Var. 5%
Seed purity (%)	0.00271	0.04427*	0.22799	0.22875
Inert matter (%) (g)	0.00271	0.04427*	0.22799	68.536
Thousand seed weight (mg)	202.483	49.572	6.26332	16.565
Moisture content (%)	0.07761	0.13464	0.31783	2.50843
Dead seed	4.45667	6.50846	2.03836	53.9962
Abnormal seedling	4.32531	9.61554	3.12251	60.4003
Normal Germinated seedling (%)	6.89358	17.4374	4.23263	4.64897

DF=degree of freedom, Rep=Replications=Non significant variation and *=significant at p (0.05).

Table 2. *Mean comparison for seed qualities of 16 Bread wheat verities.*

Number	Varieties name	Seed purity (%)	Inert matter (%) (g)	Thousand seed weight (mg)	Moisture content (%)	Dead seed	Abnormal seedling	Normal Germinated seedling (%)
1	Ogolcho (Pb)	99.575^{ab}	0.425^{ab}	35.12^{abc}	12.5925^{abc}	4.295^{abc}	6.505^{ab}	89.005^{bc}
2	Lemu (Pb)	99.6325^{ab}	0.3675^{ab}	40.675^{ab}	12.63^{ab}	3.853^{ab}	6.463^{ab}	88.935^{bc}
3	Hidasse (Pb)	99.665^{ab}	0.335^{ab}	36.575^{ab}	12.4575^{bc}	3.64^{bc}	3.473^{b}	93.64^{ab}
4	Daka (Pb)	99.5375^{ab}	0.4625^{ab}	37.2^{ab}	12.5425^{bc}	4.75^{abc}	4^{b}	91.25^{abc}
5	Danda'a (Pb)	99.805^{ab}	0.195^{ab}	33.015^{bc}	12.4375^{bc}	4.918^{abc}	3.918^{b}	91.418^{abc}
6	Kingbird (Pb)	99.52^{ab}	0.48^{a}	40.26^{ab}	12.52^{bc}	3.295^{bc}	6.39^{ab}	90.055^{abc}
7	Wane (Pb)	99.6925^{ab}	0.3075^{ab}	40.245^{ab}	12.97^{ab}	2.788^{c}	4.52^{ab}	91.743^{abc}
8	Shorima (Pb)	99.62ab	0.38^{ab}	28.618^{bc}	12.845^{ab}	2.793^{c}	6.055^{ab}	91.185^{abc}
9	Danda'a (Br)	99.8275^{ab}	0.1725^{ab}	40.118^{ab}	12.7625^{abc}	2^{c}	4.25^{ab}	93^{ab}
10	Hidasse (Br)	99.69^{ab}	0.31^{ab}	38.388^{ab}	13.0175a	4.918^{ab}	4.918^{ab}	90.168^{abc}
11	Lemu (Br)	99.6975^{ab}	0.3025^{ab}	36.73^{ab}	12.945^{ab}	4.543^{ab}	5.07^{ab}	91.16^{abc}
12	Wane (Br)	99.7375^{ab}	0.2625^{ab}	40.308^{ab}	12.5975^{bc}	7.028^{a}	6.413^{ab}	87.413^{c}
13	Daka (Br)	99.8125^{a}	0.1875^{ab}	39.638^{ab}	12.62^{abc}	2.5^{c}	2.25^{b}	95.25^{a}
14	Danda'a (Br)	99.72^{ab}	0.28^{b}	36.358^{ab}	12.59^{bc}	2.548^{c}	5.103^{ab}	92.853^{ab}
15	Kakaba (Br)	99.6775^{ab}	0.3225^{b}	43.31^{a}	12.67^{bc}	2.813^{bc}	8.75^{a}	88^{bc}
16	Ogolcho (Br)	99.4675^{b}	0.5325^{b}	38.415^{ab}	12.53^{bc}	3.723^{bc}	4.64^{ab}	91.64^{abc}
	Critical Value of t at (0.05)	2.0141	2.0141	2.0141	2.0141	2.0141	2.0141	2.0141
	Least Significant Difference	0.3247	0.3247	8.9201	0.4526	2.903	4.447	6.0281

Means with the same letters are not statistically significant. (Br)=Breeder seed class, (Pb)=pre basic seed class.

3. Results and Discussion

The highest seed purity was recorded by Hidase (br) (99.812) followed by Danda.a (pb) with (99.8) while the lowest seed purity was observed on Ogolcho (br) with (99.46) all varieties were fitting the minimum purity standard for next seed production. The maximum inert matter (0.48%) was observed on kingbird (pb) while the lowest Inert matter (0.17%) was observed on Danda.a (br). The highest thousand seed weight (43.3g) was recorded by Kakaba (br) while the lowest (28.6g) was recorded by shorima (pb). The maximum Moisture content (13.01%) at storage was observed on Daka (br). Daka (br) with (95.25%) showed the highest germination potential followed by Hidase (pb) with (93.63%) of normal Germination while wane (br) with (87.41%) showed the lowest germination. Generally all the variety was accepted for distribution of the seeds as they fit required seed quality parameters. According to Kizilgeci et al. (2017) germination of seed can affected by environment where it produced [16, 13]. Thousand seed weight of the variety may affected by where they grow and genetic potential of the variety according to Negash Geleta et al. [15].

Figure 1. *Seed cleaning process.*

Table 3. *Summary statistic for the seed quality parameters.*

Measures	Seed purity (%)	Inert matter (%) (g)	Thousand seed weight (mg)	Moisture content (%)	Dead seed	Abnormal seedling	Normal Germinated seedling (%)
#Treatments	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Minimum	99.57	0.10	27.86	12.67	1.00	2.00	85.00
Maximum	99.90	0.43	36.12	12.82	8.00	10.00	97.00
Mean	99.67	0.33	32.59	12.77	3.54	5.87	90.18
Std. error	0.03	0.03	0.41	0.01	0.38	0.67	0.80
Variance	0.01	0.01	2.74	0.00	2.32	7.25	10.12
Stand. Dev	0.10	0.10	1.66	0.03	1.52	2.69	3.18
Coeff. Var	0.10	31.66	5.08	0.27	43.05	45.91	3.53

Dead seeds and inert matter composition highest cv value which implies Only few of the varieties has impurity while most of the varieties record highest seed purity standard.

During Germination test only normally germinated seedling can be counted as Germinated seed while Dead seed (un germinated) and Germinated Abnormal seed ling cannot counted according to ISTA seed germination procedures.

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. The maximum inert matter (0.48%) was observed on kingbird (pb) while the lowest Inert matter (0.17%) was observed on Danda.a (br). Daka (br) with (95.25%) showed the highest germination potential followed by Hidase (pb) with (93.63%) of normal Germination while wane (br) with (87.41%) showed the lowest germination.

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, their uniformity.

Generally the result from this study indicates that all the varieties fit minimum standard for the next seed production. 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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Appendix

Some supplementary photos and graphs.

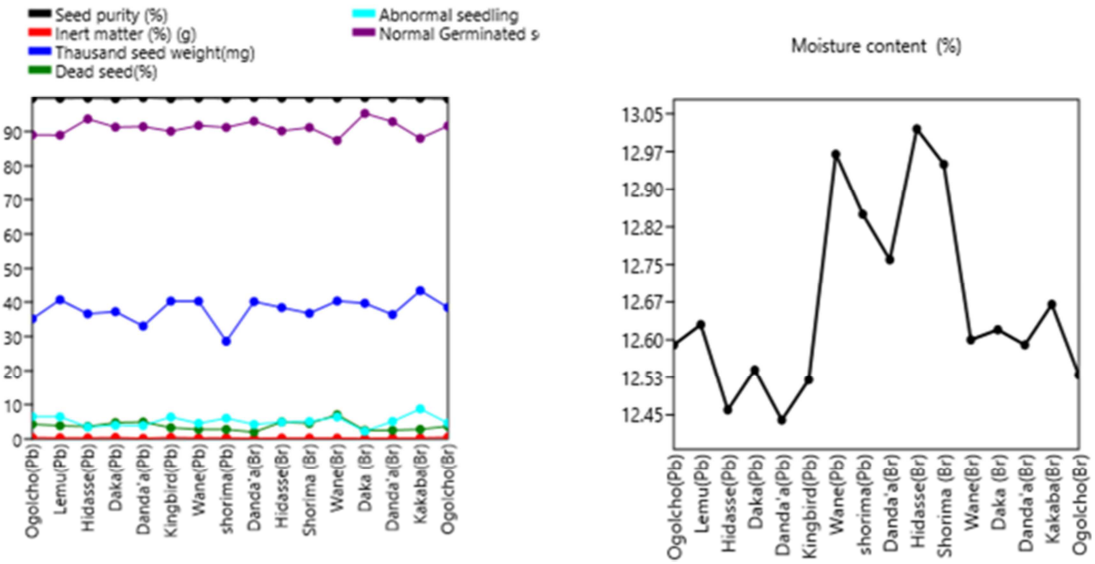

Figure 2. *Different varieties of Bread wheat Seed purity, (%) TSW (g), Germination and MC (%) by graph.*

Figure 3. *Some photos during germination.*

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