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# Assessment of Rice (*Oryza sativa* L.) Seed Quality from Different Seed Sources in Fogera, North Western Ethiopia

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***Abstract:*** **Quality seed is vital input for increasing agricultural productivity and for next generation seed quality. Assessing different seed sources on physical, physiological and seed health tests are important for rice seed quality production. Therefore, this experiment was conducted to assess the quality of rice seed from different seed sources. An experiment was conducted both in field and laboratory conditions. A field experiment was conducted in Fogera National Rice Research and Training Center during 2017 and 2018 main cropping seasons using a randomized complete block design with three replications and laboratory experiment was conducted at Holleta Agricultural Research Center and Fogera National Rice Research and Training Center by taking representative seed samples. Data was collected on various characters and subjected to analysis of variance. The analysis of variance showed that number of unfertile tillers, unfilled spikelet per panicle, number of off type, physical purity and percentage of pathogen infected seeds were significantly different on seed sources. From the results of this study off type and seed born fungal microorganisms are major problems for deteriorating seed quality. Farmers seed sources highly deteriorated and infested by fungal microorganism than other seed sources. Therefore, farmers should be carry out adequate rogue out and used healthy seed on their rice production including other seed producing institutions to increase seed quality and minimize crop failure as a result of poor pre and post harvest management and famers should be able to source their rice seeds from reliable seed handlers.**

***Keywords:*** **Oryza sativa, Rice, Seed quality, Seed sources, Seed health.**

## 1. INTRODUCTION

Rice (*Oryza sativa* L.), which belongs to the genus Oryza, tribe Oryzeae and family Poaceae, is a staple food for half of the world's population (Tobias *et al*., 2012). Globally, more than 3.5 billion people depend on rice for more than 20% of their daily calories (IRRI, 2012). It is an important staple food crop in Africa with a growing demand that poses an economic challenge for the African continent. Rice was first introduced in Ethiopia in the 1970s and has been cultivated in small pockets of the country today (Yemane, 2014). The area under rice production in Ethiopia is estimated to have increased from 5,400 ha in 1993 to about 46,832 ha in 2014 (FAOSTAT, 2017). The number of farmers engaged in rice production has also increased from about 53 thousand in 2006 to about 284 thousand in 2009 (MoARD, 2010). It was is a productive crop next to maize in the country (CSA, 2003) and considered as the "millennium crop" which is expected to contribute to ensuring food security in Ethiopia (Hadush, 2015). The production of rice started in Amhara region at Fogera plain and at Gambella in Ethiopia. In Fogera districts its production in hectare has been increasing year after year (CSA, 2013) and Fogera plain contributes about 32% of rice production in the country (EIAR, 2011).

Rice is currently considered as a strategic food security crop and its use as a food crop, income source, employment opportunity and animal feed has been well recognized in Ethiopia (Teshome and Dawit, 2011). However, rice is an

important cereal crop in the country, its production and productivity limited due to; poor managements of rice grain, limited participation of seed growers in the production and marketing of rice seed, poor access and use of modern postharvest techniques and equipment, poor knowledge of producers and others about rice product quality (EUCORD, 2012).

Seed quality is one of the major factors that determines the success or failure of a crop. It is of great agronomic and economic concern and its importance in crop production cannot be overemphasized. The availability, access and use of quality seed of adaptable crop varieties, are critical in increasing agricultural productivity, ensuring food security and improving farmers livelihoods. Maintaining seed quality is essential if the variety is to meet the expectation of farmers and consumers. Mbora *et al*. (2009) reported that seeds of the best quality will result in crops of the best quality in the field which will result to yields of the highest value. Seed quality describes the potential performance of a seed of an improved variety which has varietal and physical purity, low moisture content, high germination and vigour, free from weeds and seed-borne pathogens, uniform and properly processed for distribution to farmers (van-Gastel *et al*., 1996). Farmers often use seeds that have impurities and contaminants and are infected with pathogens (Fujisaka *et al*., 1993). For achieving optimum growth and yield production, the basic requirement of farming is to obtain quality seed (Molnar *et al*., 2005). Rickman *et al*. (2006) reported that the quality of the seed was very important to farmers as it measures the potential performance of the seed under optimal conditions.

Quality seed is vital input for increasing agricultural productivity and for next generation seed quality. It could be verified in several ways through seed testing and field quality inspections. Therefore, it is necessary to test or assess the quality of seed both in field and laboratory to know their suitability in terms of quality and yield besides determining purity and health of seed lot. Currently different off-types which cause physical contamination on rice seed production are observed during seed production of rice farmers, cooperatives and other rice producers. Therefore, the present study was conducted to assess the quality of rice seed from different seed sources in Fogera, north western Ethiopia.

## 2. MATERIALS AND METHODS

### Description of the Study Area

The field experiment was conducted at Fogera National Rice Research and Training Center (FNRRTC), Ethiopia in 2017 and 2018 cropping seasons. Fogera National Rice Research and Training Center is 607 km far from the capital city of Addis Ababa and about 55 km from Bahirdar, the capital city of Amhara regional state (Alamir *et al*., 2019). Geographically, the experimental site is located at 11° 58' North latitude and 37° 41' East longitude with an altitude of 1819 m.a.s.l. The site receives a mean annual rainfall of 1230 mm with an average minimum and maximum temperature of 12°C and 28°C, respectively (Dessie, 2015). The soil textural class of the experimental area is clay soil with pH of 6.05 (Zelalem *et al.*, 2017). Laboratory experiment was conducted at Holeta agricultural research center and Fogera National Rice Research and Training Center.

### Experimental Materials

Seed of Ediget rice variety breeder, pre-basic, cooperative and farmer's seeds were used in the experiment. The seeds were collected from different seed sources which were breeder and pre basic seed from Fogera National Rice Research and Training Center, cooperative seed from lowland rice seed producing cooperatives and farmer's seed brought from randomly selected rice producer's farmers.

### Experimental Design and Procedures

Field experiment was conducted at Fogera National Rice Research and Training Center experimental station. The experiment was arranged in Randomized Complete Block Design (RCBD) with three replications. Each experimental plot had 25 rows at a spacing of 20cm, having plot length of 5m and width of 5m. Spacing between plots was 1m and the distance between replications was 1.5m. The experimental field was selected and all unwanted materials like straw, weed and others were removed. The land was prepared very well by ploughing two times using tractor and human labor. Rows were made by hand pulled row-marker. Fertilizer was applied at the rate of 60.5 kg NPS/ha and125 kg urea/ha based on the area specified. Sowing was done by hand drilling at the seed rate of 80 kg/ha. Full dose of P and one third of N was applied at the time of planting and the remaining urea divided in to two parts and side dressed at mid tillering and panicle initiation stages of the crop. All other recommended agronomic practices were kept normal and uniform to ensure normal plant growth and development at the experimental field.

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Laboratory works were done at Holleta Agricultural Research Center and some parameters were done in Fogera National Rice Research and Training Center by taking representative seed samples based on International Seed Testing Association (ISTA, 2014) procedures.

**Data Collection**

Data was collected under field and laboratory conditions. Data on plant height (cm), panicle length (cm), number of tillers per $m^2$, number of fertile tillers per $m^2$, number of unfertile tillers per $m^2$, spikelet number per panicle, unfilled spikelet per panicle, number of off type ($m^2$), shoot biomass (t/ha) and grain yield (t/ha) were collected in field condition. Shoot biomass (t/ha) and grain yield (t/ha) were assessed on plot basis and then converted into ton per hectare. On the other hand plant height (cm), panicle length (cm), spikelet number per panicle and unfilled spikelet per panicle were recorded on previously selected and tagged five random samples of plants from the central parts of each plot; whereas mean values of the five random samples of plants per plot were then used for the analysis of data collected on individual plant basis.

Physical purity (%), moisture content (%), thousands seed weight (g), standard germination (%), seedling length (cm), seedling dry weight (g), Vigour Index-I (VI-I), Vigour Index-II (VI-II) and seed health were collected in laboratory condition based on International Seed Testing Association (ISTA, 2014) rules and regulations.

**Data Analysis**

All the collected agronomic and growth components and laboratory data were subjected to analysis of variance (ANOVA) as suggested by Gomez and Gomez (1984) using SAS statistical software (9.2) version. Analysis of variance was carried out and Least significant difference (LSD) test was used to compare the mean separations at $P<0.05$.

## 3. RESULTS AND DISCUSSION

**A. Field Results**

The analysis of variance over years revealed that there were significant difference (*P<0.05*) among seed sources for number of unfertile tillers, unfilled spikelet per panicle and number of off type and also significance difference on the interaction (Table 1 & 2). However; plant height, panicle length, number of tillers, number of fertile tillers, spikelet number per panicle, shoot biomass and grain yield were non-significant (*P<0.05*) among the treatments and interaction. The variation for number of unfertile tillers ranged from 3.67 to 35.33. The maximum number of unfertile tillers was recorded from farmers seed (35.33) followed by cooperative seed (11.17), while the minimum number of unfertile tillers recorded from breeder seed (3.67) followed by pre basic seed (9.00) (Table 3). This implies that breeder and pre basic seeds were more vigorous than farmers and cooperative seeds. Maximum unfilled spikelet was exerted by cooperative (5.23) followed by farmers (3.83), while the minimum unfilled spikelet was revealed by pre basic (3.17) followed by breeder (3.60) (Table 4). Spikelet number had not significantly affected by seed sources and the interaction between years by treatment. These results are in contrast with those of Zofajova and Uzik (1996) reported significant difference among the seed categories.

**Table 1. Mean square from the first year (2017) and second year (2018) combined analysis of variance for seed sources**

| SOV | DF | PH (cm) | PL (cm) | NT ($m^2$) | NFT ($m^2$) | NUFT ($m^2$) | SNPP |
|---|---|---|---|---|---|---|---|
| Rep | 2 | 3.26 | 0.36 | 6.50 | 33.50 | 0.67 | 52.91 |
| Year | 1 | 1763*** | 143.6*** | 54150*** | 51801*** | 1080*** | 7399.1*** |
| TRT | 3 | $12.26^{ns}$ | $2.12^{ns}$ | $1711.4^{ns}$ | $1713.8^{ns}$ | 1184.8*** | $248.52^{ns}$ |
| YxTrt | 3 | $25.35^{ns}$ | $0.23^{ns}$ | $3805.7^{ns}$ | $3953.7^{ns}$ | 931.6*** | $130.12^{ns}$ |
| Error | 14 | 27.55 | 1.74 | 1476.6 | 2738.8 | 3.81 | 177.40 |
| CV (%) | - | 6.80 | 8.02 | 13.20 | 19.13 | 13.20 | 18.42 |

*ns= non significant, *=significant, **= highly significant, ***= very highly significant at P<0.05, SOV= Source of variance, DF=Degree of freedom, CV=Coefficient of variance, Rep= replication, YxTrt= year x treatment, PH (cm)= plant height in centimeter, PL (cm)= panicle length in centimeter, NT ($m^2$)=number of tillers in meter square, NFT ($m^2$)= number of fertile tillers in meter square, NUFT ($m^2$)= number of unfertile tillers in meter square and SNPP= spikelet number per panicle.*

**Table 2. Mean square from the first year (2017) and second year (2018) combined analysis of variance for seed sources (*continued*)**

| SOV | DF | UFSPP | NOFT ($m^2$) | SB (t/ha) | GY (t/ha) |
|---|---|---|---|---|---|
| Rep | 2 | 0.19 | 1.17 | 18.66 | 0.05 |
| Year | 1 | 45.38*** | 100.04*** | 988.16*** | 17.78*** |
| TRT | 3 | 4.79** | 531.93*** | $5.52^{ns}$ | $0.06^{ns}$ |
| YxTrt | 3 | 12.75*** | 16.15* | $27.41^{ns}$ | $0.42^{ns}$ |
| Error | 14 | 0.74 | 3.60 | 9.36 | 0.16 |
| CV (%) | - | 21.69 | 19.04 | 19.22 | 10.78 |

*ns= non significant, *=significant, **= highly significant, ***= very highly significant at P<0.05, SOV= Source of variance, DF=Degree of freedom, CV=Coefficient of variance, Rep= replication, YxTrt= year x treatment, UFSPP= unfilled spikelet per panicle, NOFT ($m^2$)= number of off type in meter square, SB (t/ha)= shoot biomass in ton per hectare and GY (t/ha)= grain yield in ton per hectare.*

**Table 3. Mean of assessment of rice seed quality from different seed sources (combined analysis of year 1 and year 2)**

| Seed sources | PH (cm) | PL (cm) | NT ($m^2$) | NFT ($m^2$) | NUFT ($m^2$) | SNPP |
|---|---|---|---|---|---|---|
| Pre-basic | 77.50 | 16.43 | 270.00 | 261.00 | $9.00^{b}$ | 76.53 |
| Breeder | 76.08 | 15.68 | 285.50 | 262.00 | $3.67^{c}$ | 65.10 |
| Cooperative | 79.03 | 17.13 | 308.33 | 297.33 | $11.17^{b}$ | 78.80 |
| Farmers | 76.00 | 16.53 | 300.17 | 274.17 | $35.33^{a}$ | 68.80 |
| Mean | 77.15 | 16.44 | 291.00 | 273.63 | 14.79 | 72.31 |
| CV (%) | 6.80 | 8.02 | 13.20 | 19.13 | 13.20 | 18.42 |
| LSD (5%) | NS | NS | NS | NS | 2.42 | NS |

*Column of Means with the same letter (s) are not significantly different at P<0.05; where PH (cm)= plant height in centimeter, PL (cm)= panicle length in centimeter, NT ($m^2$)=number of tillers in meter square, NFT ($m^2$)= number of fertile tillers in meter square, NUFT ($m^2$)= number of unfertile tillers in meter square, SNPP= spikelet number per panicle, CV= coefficient of variance, LSD= least significant difference and NS= non significant.*

**Table 4. Mean of assessment of rice seed quality from different seed sources (combined analysis of year 1 and year 2) (*continued*)**

| Seed sources | UFSPP | NOFT ($m^2$) | SB (t/ha) | GY (t/ha) |
|---|---|---|---|---|
| Pre-basic | $3.17^{b}$ | $4.50^{c}$ | 15.67 | 3.63 |
| Breeder | $3.60^{b}$ | $3.17^{c}$ | 16.58 | 3.67 |
| Cooperative | $5.23^{a}$ | $8.50^{b}$ | 14.67 | 3.70 |
| Farmers | $3.83^{b}$ | $23.67^{a}$ | 16.75 | 3.86 |
| Mean | 3.96 | 9.96 | 15.92 | 3.72 |
| CV (%) | 21.69 | 19.04 | 19.22 | 10.78 |
| LSD (5%) | 1.06 | 2.35 | NS | NS |

*Column of Means with the same letter (s) are not significantly different at P<0.05; where UFSPP= unfilled spikelet per panicle, NOFT ($m^2$)= number of off type in meter square, SB (t/ha)= shoot biomass in ton per hectare, GY (t/ha)= grain yield in ton per hectare CV= coefficient of variance, LSD= least significant difference and NS= non significant.*

From the combined analysis the variation for number of off type ranged from 3.17 to 23.67. Farmers seed (23.67) followed by cooperative (8.50) had scored a maximum number of off type, while breeder and pre basic seed had scored a minimum number of off type 3.17 and 4.50 respectively (Table 4). This implies that farmer's seed had a much amount of off types from other seed source; it might not be rogue out at the time of farmer's field production. Off types are one of the major seed quality deteriorates and decrease the quality of seed and productivity of the crop and it reduced for next generation seed quality. These results are in complete agreement with those reported by El-Kalla *et al.* (2010). Statically analysis showed that seed sources were non- significant for biological yield. These results are in contradicted to Stanton

(1985) who found higher biological yield from certified seed as compared to farmer's seed and also Amir *et al*. (2007). Even if; number of unfertile tillers and unfilled spikelet per panicle were significant difference among the treatments grain yield showed non-significant difference on the treatment. These findings are in contrast with those of Podlaski and Wyszkowska (1994) reported large seed size obtained from certified seed category. Amir *et al*. (2007) also conducted different seed categories; they reported considerable variation in grain yield of different seed categories.

**B. Laboratory Results**

Analysis of variance showed that there was significant difference (*P<0.05*) among the seed sources for physical purity (Table 5). Physical purity is a major character for determination of quality seed. Differences among the seed sources were significant for percentage of pure seeds. The proportions of pure seed for samples tested from breeder (99.55%) followed by pre basic (99.12%) were in the highest range of the purity standard of rice seed in Ethiopia (Table 5). Similarly, pure seed percentages of cooperative 98.39% and farmers 97.25% which were also above rice seed purity standard of the country (Table 5). According to the national rice seed standard, the percentage of pure seed for breeder and pre basic seed 99% basic 98% and certified seed 97%. These results are in line with Setegn *et al.* (2014) noted that significant difference on physical purity. Moisture content is the major determinant factor for seed storage and seed quality. Data recorded on moisture content are presented in Table 5. Differences in seed moisture content were not significantly difference among the seed sources. Thousands seed weight is an essential factors towards the final grain yield and further depend up on crop growth in terms of productivity. As indicated in Table 5, there was non- significant variations (*P<0.05*) among the seed sources. These results also contradict with Amir *et al*. (2007) reported that significant variation in thousands seed weight among different seed categories.

**Table 5. Mean of physical and physiological qualities of rice seed sources**

| Seed sources | Purity (%) | MC (%) | TSW (g) | SG (%) | SL (cm) | SDW (g) | VI-I | VI-II |
|---|---|---|---|---|---|---|---|---|
| Pre-basic | 99.12$^{ab}$ | 14.35 | 33.70 | 94.67 | 14.24 | 0.59 | 1348 | 55.47 |
| Breeder | 99.55$^{a}$ | 14.85 | 32.87 | 94.67 | 15.08 | 0.60 | 1428 | 56.57 |
| Cooperative | 98.39$^{b}$ | 14.35 | 33.28 | 93.67 | 15.27 | 0.60 | 1430 | 55.88 |
| Farmers | 97.25$^{c}$ | 13.40 | 34.13 | 93.33 | 13.79 | 0.59 | 1287 | 55.41 |
| Mean | 98.58 | 14.24 | 33.50 | 94.09 | 14.60 | 0.60 | 1373 | 55.83 |
| CV (%) | 0.51 | 10.58 | 5.15 | 1.11 | 5.92 | 4.84 | 6.71 | 4.83 |
| LSD (5%) | 1.00 | NS | NS | NS | NS | NS | NS | NS |

*MC (%)= moisture content in percent, TSW (g)= thousands seed weight in gram, SG (%)= standard germination in percent, SL (cm)= seedling length in centimeter, SDW(g)= seedling dry weight in gram, VI-I= Vigour Index I, VI-II= Vigour Index II, CV= coefficient of variance, LSD= least significant difference and NS= non significant.*

Standard germination of rice seed was not significant among the seed sources (*P<0.05*). Breeder and pre basic seeds exhibited relatively better normal germination (94.67%) than cooperative and farmer seeds 93.67% and 93.33% respectively (Table 5). All of breeder, pre basic, cooperative and farmer seeds are fulfilled the national standard set 90%, 85% and 80% for Breeder/pre basic, basic and certified seeds for rice seed in Ethiopia. These results are contradicted to Setegn *et al.* (2014) reported significant difference among common bean seed qualities. Seedling length and seedling dry weight are important characters which determines seed physiological qualities of seed. As indicated in Table 5, average seedling length and seedling dry weight among the rice seed sources were not significantly affected by seed sources (*P<0.05*). These results of seedling length are contradict to Setegn *et al*. (2014) conducted assessment of common bean seed quality produced under different cropping systems by smallholder farmers in eastern Ethiopia and reported considerable variation in seedling length but, in line with seedling dry weight.

There was non-significant difference among seed sources for Vigour Index I (VI-I). And also non-significant difference was observed on Vigour Index II among the seed sources at (*P<0.05*) which was ranged from 55.41 (farmer seed) to 56.57 (breeder seed) (Table 5). Seeds that had higher speed of germination were generally considered more vigorous. Moreover, vigorous seeds could be stored for longer periods without loss of germination. Vigour test measure the potential for rapid, uniform emergence of seeds under a wide range of field conditions (Elias *et al*., 2010). Also this study result is in contrast to the finding of Setegn *et al.* (2014) reported significant difference among seed categories in vigour indices.

The presence and type of fungi were determined according to their development on seed, which had been incubated on Potato Dextrose Agar (PDA) medium. Nine fungal species were identified; *Pyricularia oryzae*, *Nigrospora oryzae*, *Bipolaris oryzae*, *Alternaria alternata*, *Penicillium* sp., *Fusarium moniliforme*, *Magnaporthe salvinii*, *Curvularia oryzae* and *Fusarium oxysporum* (Table 6). As indicated from the result seven fungal pathogen *Pyricularia oryzae*, *Nigrospora oryzae*, *Bipolaris oryzae*, *Alternaria alternata*, *Penicillium* sp., *Fusarium moniliforme* and *Magnaporthe salvinii* occurred in all seed sources but, *Curvularia oryzae* occurred on seed sources of breeder, cooperative and farmers seeds and *Fusarium oxysporum* occurred on breeder and pre basic rice seed sources. The result indicated that high incidence of fungal pathogens observed at *Bipolaris oryzae* of pre basic seed 51.75%, breeder 49.17%, farmer 46.67% and cooperative 37.50%, at *Pyricularia oryzae* farmers seed 45%, cooperative 38.33%, pre basic 35% and breeder 30% and at *Alternaria alternata* scored on farmer seed 38.33%, cooperative 27.50%, pre basic 24.17% also breeder 24.17% but, the lower incidence fungal diseases observed at *Fusarium oxysporum* on cooperative and farmers seeds (0.00%) , while breeder and pre basic seeds scored 1.67%. Although lower fungal incidence was observed at *Penicillium* sp., on breeder seed 0.83%, cooperative 0.83%, farmer 2.50% and pre basic seed 3.33% (Table 6).

*Xanthomonas oryzae* pv. o*ryzicola* is the only bacterial disease found associated with rice seed sources. Among the identified bacterial species, *Xanthomonas oryzae* pv. *Oryzicola* was detected in 0.83% both on breeder and pre basic seeds but not detected from cooperative and farmer seed sources 0.00% (Table 6). The result showed that bacteria has not a major effect on rice seed quality and this bacteria might not be pathogenic to rice but their presence on the seeds is known to negatively affect seed germination.

The major micro organisms observed fungal pathogen on rice seed sources were *Bipolaris oryzae*, *Pyricularia oryzae* and *Alternaria alternata*. The highest Proportion of seeds infected by microorganisms observed at farmer seed with a mean value of 15.00%; while the lower proportion of seeds infected by microorganisms observed at breeder seed sources a mean value of 11.75% (Table 6). It indicates that Farmers seed had more affected by microorganisms than other seed sources. Thus, farmers are advised not to retain seeds over long periods as this may result in pathogen build-up and creating awareness through trainings/field-days etc., for the use of good quality healthy seed will have a substantial impact on sustainability of food security in the country. The results of present study are in agreement with those of Raj *et al*. (2007), during their studies on seed health status, reported different fungal genera associated with famers' saved seed of various crops viz., paddy, sorghum, sunflower and cowpea and the prevalence of seed mycoflora varied with variety of the crop and method of storage.

**Table 6. Mean percentage comparison of seed infection with microbes between rice seed sources**

| Fungal/ bacterial Species detected | Proportion of seeds infected (%) | | | |
|---|---|---|---|---|
| | Pre-basic | Breeder | Cooperative | Farmer |
| *Pyricularia oryzae* | 35.00 | 30.00 | 38.33 | 45.00 |
| *Nigrospora oryzae* | 3.33 | 1.67 | 3.33 | 1.67 |
| *Bipolaris oryzae* | 51.75 | 49.17 | 37.50 | 46.67 |
| *Alternaria alternata* | 24.17 | 24.17 | 27.50 | 38.33 |
| *Penicillium* sp., | 3.33 | 0.83 | 0.83 | 2.50 |
| *Fusarium moniliforme* | 6.67 | 3.33 | 4.17 | 5.83 |
| *Magnaporthe salvinii* | 4.17 | 4.17 | 9.17 | 5.00 |
| *Curvularia oryzae* | 0.00 | 1.67 | 10.00 | 5.00 |
| *Fusarium oxysporum* | 1.67 | 1.67 | 0.00 | 0.00 |
| *Xanthomonas oryzae* pv. *oryzicola* | 0.83 | 0.83 | 0.00 | 0.00 |
| **Mean** | **13.09** | **11.75** | **13.08** | **15.00** |

*Pyricularia oryzae*, *Nigrospora oryzae*, *Bipolaris oryzae*, *Alternaria alternata*, *Penicillium* sp., *Fusarium moniliforme*, *Magnaporthe salvinii*, *Curvularia oryzae* and *Fusarium oxysporum* are fungal diseases and *Xanthomonas oryzae* pv. O*ryzicola* is a bacterial disease.

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## 4. CONCLUSION

Analysis of variance showed that number of unfertile tillers, unfilled spikelet per panicle, number of off type, physical purity and percentage of pathogen infected seeds were significantly different among the seed sources. From the results of this study number of off type and seed born fungi are major problems for deteriorating seed quality. The maximum number of off type was observed on Farmer seed sources 23.67, but the minimum number of off type recorded on breeder seed sources 3.17. The major rice seed born micro organisms observed fungal pathogen on rice seed sources were *Bipolaris oryzae*, *Pyricularia oryzae* and *Alternaria alternata*. The highest Proportion of seeds infected by microorganisms observed at farmer seed with a mean value of 15.00% while the lower proportion of seeds infected by microorganisms observed at breeder seed sources a mean value of 11.75%. Generally, farmers' seed sources were highly deteriorated and infested by fungal microorganism than other seed sources. Therefore, farmers should be carry out adequate rogue out and used healthy seed on their rice production including other seed producing institution to increase seed quality and minimize crop failure as a result of poor pre and post harvest management and famers should be able to source their rice seeds from reliable seed handlers. In addition the present findings will help the researchers for further investigations and ultimately our farmers to use healthy and quality seed.

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