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Comparison of Different Wheat Seed Categories (Vs) Farmer's Seed: Yield and Yield Components

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Abstract: To evaluate the effect of different wheat seed categories with farmer's seed for yield and yield components. An experiment was conducted at Agriculture Research Farm, NWFP Agricultural University, Peshawar, during 2003-04. The experiment was laid out in Randomized Complete Block (RCB) design with four replications. The seed categories were pre-basic, basic and certified seed of wheat varieties Bakhtawar-92 and Fakhri Sarhad from CCRI, Pirsabak and were compared with farmer's seed of the same varieties collected from 4 location of the province. Maximum emergence m^{-2} (183) was recorded from pre-basic seed of Bakhtawar-92 and Fakhri Sarhad collected from CCRI, Pirsabak followed by basic and certified seed category of the same location. Farmer's seed collected from Peshawar locality gave minimum emergence m^{-2} (73) among different seed categories. Pre-basic category of Bakhtawar-92 obtained from CCRI, Pirsabak gave maximum spikes m^{-2} (347.3), grains spike⁻¹ (52.30), biological yield (11500 kg ha⁻¹), grain yield (4931 kg ha⁻¹), thousand grain weight (52.75 g) and harvest index (43.11%), followed by basic and certified categories of the same varieties and location. Among farmer's seed, Bakhtawar-92 collected from Charsadda and Nowshera locality performed better in all yield parameters as compared to other locations. Farmer's seed collected from Peshawar and Mardan performed poorly in maximum yield parameters. It is concluded that pre-basic seed of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI, Pirsabak showed better performance in all agronomic parameters and may be recommended for higher production under the agroclimatic conditions of NWFP-Pakistan.

Key words: Seed categories, wheat, yield and yield components

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the main staple food of Pakistan. It contributes 12.5% to the value added in agriculture and 3.1% to GDP. Wheat has a great potential for yield than any other cereal crop but the average yield is very low in Pakistan than other wheat growing countries of the world (Minfal, 2003). The low yield is partly due to poor quality seed which results poor germination and improper establishment of the crop in the field. Proper and uniform stand establishment are the key factors for successful crop production in all cropping systems. To ensure such stands, even under adverse conditions, high vigor seeds must be planted (Salepelto and Peltonen, 1995). Different seed lots may be mechanically graded by seed size on a commercial scale with relative ease; consequently, the effects on seed vigor, as expressed in percent emergence, speed of emergence and yielding ability have been studied quite extensively (Douglas *et al.*, 1994). Seeds of crops are graded and sized to

facilitate uniform planting. Grading eliminate damaged seeds and contributes to a relatively uniform product (Newman and Moser, 1988). There is increasing interest in the use of low priced grades of wheat seed. In our country farmers either use their own farm produced seed or buy seed from markets. Different categories of seed are available to farmers for sowing purpose depending upon, where a farmer can go for obtaining quality seed. Recently many private seed companies and semi-government organizations have come forward in the seed trade. There are some private seed businessmen, who sell seed in markets, spread out in the country. Farmers also get seeds from government agencies and fellow farmers. Thus wide ranges of seed categories are available to farmers for planting purpose at sowing time. Seed size is highly correlated with seedling weight. Large seeds yield more than an equal number of small seeds; however most studies on seed size reveal that large and small seeds (un-graded) produce almost the same yield if the same seed rate by weight is used. Limited information is available pertaining to the evaluation of different classes of wheat seed collected from different locations. Therefore, the present study was undertaken to evaluate the performance of different wheat seed categories (vs) farmer's seed for yield and yield components.

MATERIALS AND METHODS

Seed of wheat varieties Bakhtawar-92 and Fakhri Sarhad were evaluated during 2003-2004 at Agricultural Research Farm, NWFP Agricultural University Peshawar. Seed of the same varieties was collected from two different farmers in each of the four districts of Charsadda, Mardan, Nowshera and Peshawar. Information about seed age is given in Table 1. The performance of the farmers seed collected from different location were compared with the pre-basic, basic and certified seed of both varieties obtained from CCRI, Pirsabak. The experiment was laid out in randomized complete block design, having four replications. A plot size of 3×5 m having 10 rows 30 cm apart and 5 m long was used. The soil of the experimental site was silty clay loam with a clay type montmorillonite, low in nitrogen (0.03-0.04%), low in organic matter (0.8-0.9%) and alkaline in reaction with a pH of 8.0-8.2 (Shah *et al.*, 1993). A basal dose of 120 kg ha⁻¹ of urea (46% N) and 60 kg ha⁻¹ of D.A.P (18% N and 46% P₂O₅) were applied 1 day before seeding, whereas the remaining half of Urea were applied at booting stage.

Normal cultural practices for raising a successful crop were followed uniformly for all the experimental units. Irrigation was applied whenever required. Data were recorded on the following observations according to standard procedure: emergence (m⁻²), spikes (m⁻²), No of grains spike⁻¹, biological yield (kg ha⁻¹), grain yield (kg ha⁻¹), 1000-grain weight (g) and harvest index (%).

Statistical Analysis

Data were statistically analyzed using analysis of variance appropriate to RCB Design. Upon obtaining significant differences, Least Significant Difference (LSD) test at 0.05 level of probability was used for comparison among the treatments means.

Table 1: Histry of the varieties, location and their aging time

Varieties	Location	Pre-basic seed	Basic seed	Certified seed
Bakhtawar-92	Pirsabak	Fresh	Fresh	Fresh
Fakhri Sarhad	Pirsabak	Fresh	Fresh	Fresh
Bakhtawar-92	Charsadda-1	NA	NA	5 (years)
Fakhri Sarhad	Charsadda-2	NA	NA	3 (years)
Bakhtawar-92	Mardan-1	NA	NA	4 (years)
Fakhri Sarhad	Mardan-2	NA	NA	6 (years)
Bakhtawar-92	Peshawar-1	NA	NA	3 (years)
Fakhri Sarhad	Peshawar-2	NA	NA	2 (years)
Bakhtawar-92	Nowshera-1	NA	NA	2 (years)
Fakhri Sarhad	Nowshera-2	NA	NA	2 (years)

No. of year in parenthesis indicate that the farmer is using that variety for the last many years; NA: Not Applicable

RESULTS AND DISCUSSION

The data recorded on yield and yield components of different seed categories of certified and farmer's seed are reported below.

Emergence (m^{-2})

Better emergence m^{-2} is necessary for good crop stand which is further depend upon the external factor like environment and as well as internal factor like genetic makeup, seed vigour and viability. Data pertaining to emergence (m^{-2}) are reported in Table 2. Statistical analysis of the data revealed that seed categories had significant effect on emergence m^{-2} . Maximum emergence m^{-2} (183) was recorded for the pre-basic seed category of Fakhri Sarhad and Bakhtawar-92 obtained from CCRI Pirsabak and followed by basic and certified seed categories of the same varieties obtained from CCRI, Pirsabak. Minimum emergence m^{-2} (73) was recorded in farmer's seed of Fakhri Sarhad obtained from Peshawar and Nowshera Districts. Maximum emergence m^{-2} from the pre-basic seed of Fakhri Sarhad and Bakhtawar-92 from CCRI, Pirsabak, indicate the viability and vigor of the seed produced in this locality of NWFP as compared to farmer's seed of other locations. These results are in agreement with those of Arora *et al.* (1998) who reported maximum germination in certified seed as compared to farmer's seed.

Spikes (m^{-2})

Number of spikes m^{-2} is a major yield component and directly contribute to the final yield of a crop. Data recorded on spike m^{-2} are presented in Table 2. Analysis of the data shows that different seed categories significantly affected the number of spike m^{-2} . Pre-basic seed category of both varieties obtained from CCRI, Pirsabak, produced maximum (347.3) spike m^{-2} as compared to basic and certified seed categories of the same location. Farmer seed category of Fakhri Sarhad variety obtained from Charsadda gave minimum (160) spike m^{-2} followed by Mardan, Peshawar and Nowshera localities. Maximum spikes m^{-2} from the pre-basic category of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI, Pirsabak might be due to conducive environment during plant growth and development and its genetic potential as compared to farmer's seed. The possible reason might be due to poor storage and management practices for raising a successful crop. These results are in conformity with those of Zofajova and Uzik (1996) who reported maximum productive tillers and yield from the approved seed categories.

Table 2: Emergence m^{-2} , Spikes (m^{-2}) and No. of grains spike⁻¹ of wheat as affected by different seed categories 3

Seed categories	Emergence (m^2)	Spikes (m^2)	No. of grains spike ⁻¹
Pre-basic Bakhtawar-92	161.3 ^{AB}	347.3 ^A	52.30 ^A
Basic Bakhtawar-92	126.0 ^{CD}	323.3 ^{AB}	49.17 ^A
Certified Bakhtawar-92	126.0 ^{CD}	285.8 ^C	39.87 ^B
Pre-basic Fakhri Sarhad	183.0 ^A	338.0 ^A	40.60 ^B
Basic Fakhri Sarhad	136.8 ^{BC}	301.3 ^{BC}	50.60 ^A
Certified Fakhri Sarhad	112.8 ^{CD}	271.3 ^C	47.90 ^A
Bakhtawar-92 (Charsadda)	121.8 ^{CD}	200.0 ^D	38.97 ^B
Fakhri Sarhad (Charsadda)	108.3 ^{CD}	160.0 ^E	36.10 ^{BC}
Bakhtawar-92 (Mardan)	108.0 ^{CD}	185.8 ^{DE}	36.47 ^{BC}
Fakhri Sarhad (Mardan)	96.25 ^{DE}	271.8 ^C	29.10 ^D
Bakhtawar-92 (Peshawar)	116.8 ^{CD}	162.3 ^E	30.53 ^D
Fakhri Sarhad (Peshawar)	73.00 ^E	186.3 ^{DE}	33.17 ^{CD}
Bakhtawar-92 (Nowshera)	117.3 ^{CD}	202.8 ^D	33.42 ^{CD}
Fakhri Sarhad (Nowshera)	102.8 ^{DE}	286.0 ^C	40.95 ^B
LSD value at 1%	31.64	36.04	5.193

Means in same column followed by different letter (s) are significantly different at 0.01 level of probability

Number of Grains Spike⁻¹

Number of grains spike⁻¹ is a major yield contributing component. Data recorded on number of grains spike⁻¹ are presented in Table 2. Statistical analysis of the data indicates that grains spike⁻¹ of wheat varieties were significantly affected by different seed categories. Pre-basic and basic seed categories of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI Pirsabak, gave maximum number of grains spike⁻¹ (52) followed by certified seed category of both varieties. Farmer's seed obtained from Mardan locality gave minimum grains spike⁻¹ (29) as compared to other localities of the Province. The minimum grains spike⁻¹ in farmer's seed category may be due to aging of the seed which resulted poor quality seedling and poor management practices and the environment during its development. These results are in agreement with those of (Beyene *et al.*, 1999) who reported minimum productivity from poor quality seed.

Biological Yield (kg ha⁻¹)

Biological yield play a prominent role in the productivity of a crop. Data recorded on biological yield are presented in Table 3. It is revealed from the figure that biological yield of wheat varieties were significantly affected by different seed categories. Pre-basic seed category of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI Pirsabak, gave maximum biological yield (11520 kg ha⁻¹) followed by basic and certified seed category. Minimum biological yield (6333 kg ha⁻¹) was recorded in Farmer's seed obtained from Mardan and the trend of decrease was similar in all categories of farmer's seed. The reason for maximum biological yield in pre-basic seed categories of Bakhtawar-92 and Fakhri Sarhad from CCRI, Pirsabak might be high vigor of the seed and it's potential and available of favourable environment for growth and development, which play a major role in the availability of nutrients and water from the soil. Stanton (1985) found higher grain yield from certified seed as compared to farmer's seed.

Grain Yield (kg ha⁻¹)

Grain yield is the ultimate output of each and every crop. Data pertaining to grain yield are presented in Table 3. Analysis of the data shows that grain yield of wheat varieties were significantly affected by different seed categories. Pre-basic seed category of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI Pirsabak, gave maximum grain yield (4931 kg ha⁻¹) followed by basic and certified seed category of the same varieties. Farmer's seed obtained from Charsadda gave

Table 3: Biological yield, 1000-grain weight and harvest index of wheat as affected by different seed categories

Seed categories	Biological yield (kg ha ⁻¹)	1000-grain weight (g)	Grain yield (kg h ⁻¹)	Harvest index (%)
Pre-basic Bakhtawar-92	11530 ^A	52.75 ^A	4931 ^A	43.1 ^A
Basic Bakhtawar-92	10420 ^{AB}	40.75 ^D	4167 ^B	39.9 ^{AB}
Certified Bakhtawar-92	8167 ^{DE}	37.75 ^E	2684 ^{DE}	37.8 ^{ABC}
Pre-basic Fakhri Sarhad	9111 ^{CD}	49.00 ^B	3237 ^C	40.2 ^{AB}
Basic Fakhri Sarhad	9779 ^{BC}	43.75 ^C	3001 ^{CD}	38.9 ^{ABC}
Certified Fakhri Sarhad	7596 ^{EPGH}	37.25 ^{EF}	2705 ^D	36.7 ^{ABC}
Bakhtawar-92 (Charsadda)	6444 ^{GH}	34.75 ^G	2209 ^E	34.1 ^{BCDE}
Fakhri Sarhad (Charsadda)	8056 ^{DEF}	31.25 ^H	2574 ^{DE}	32.3 ^{DE}
Bakhtawar-92 (Mardan)	6333 ^H	35.00 ^G	2534 ^{DE}	33.0 ^{CDE}
Fakhri Sarhad (Mardan)	6833 ^{F³H}	31.25 ^H	2659 ^{DE}	33.1 ^{CDE}
Bakhtawar-92 (Peshawar)	8167 ^{DE}	35.25 ^{F³}	2885 ^{CD}	35.3 ^{BCDE}
Fakhri Sarhad (Peshawar)	7278 ^{EPGH}	38.00 ^E	2748 ^D	32.8 ^{CDE}
Bakhtawar-92 (Nowshera)	7833 ^{DEF}	32.00 ^H	2227 ^E	28.4 ^F
Fakhri Sarhad (Nowshera)	7637 ^{EPG}	36.25 ^{EPG}	2215 ^E	29.0 ^F
LSD value at 1%	1281.0	2.113	475.4	7.08

Means in same column followed by different letter (s) are significantly different at 0.01 level of probability

minimum grain yield (2209 kg ha⁻¹) and the trend of decrease was similar in both varieties. Maximum grain yield in pre-basic seed categories of Bakhtawar-92 and Fakhri Sarhad from CCRI, Pirsabak might be due to high vigor and genetic makeup of the seed and environmental suitability which resulted more uniform and vigorous seedling. The performance of farmer's seed was not up to the mark because of poor storage which resulted poor quality seedling. The other possible argument for less grain yield might be due to absorption of less nutrient availability and other insufficient inputs for the growth and development of the crop. These results are in line with Chastain *et al.* (1995) Agrawal and Misra (1996) Karababa *et al.* (2000) who observed more grain yield for the approved seed category.

Thousand Grain Weight (g)

Thousand grain weight is an essential factor towards the final grain yield and further depend upon crop growth, in term of productivity. Data recorded on 1000 grain weight are presented in Table 3. Analysis of variance shows that different seed categories have significantly affected 1000 grain weight. Maximum grain weight of (52.75 g) was recorded in pre-basic seed category of Bakhtawar-92 obtained from CCRI, Pirsabak, followed by pre-basic seed of Fakhri Sarhad (49 g) obtained from the same location. Farmer's seed of both varieties obtained from Charssadda gave minimum grain weight of (31.25 g) followed by the same varieties obtained from Mardan. The reason for maximum grain weight in the pre-basic seed category of Bakhtawar-92 from CCRI, Pirsabak might be due to maximum leaf area and effective seed fill duration, which contributed toward final yield. Whereas, minimum grain weight from farmer's seed of different location might be due to bad storage conditions, which resulted in less vigor seed. These findings are in agreement with those of Podlaski and Wyszowska (1994) who obtained large size seed from certified seed category and also by Zofajova and Uzik (1996) who recorded maximum seed weight for certified seed.

Harvest Index (%)

Harvest index is the ratio of grain to biological yield and is used to determine the usefulness of any crop in any environment. Data recorded on harvest index are presented in Table 3. Perusal of the data revealed that different seed categories have significantly affected the harvest index of both varieties. Maximum harvest index of (43.11%) was recorded in the pre-basic seed categories of Bakhtawar-92 and Fakhri Sarhad obtained from CCRI, Pirsabak followed by basic and certified seed categories of both varieties. Farmer's seed obtained from Mardan gave the lowest harvest Index of 40.25% and was at par with the seed obtained from Nowshera. Maximum harvest index from pre-basic seed categories of both varieties might be due to more grain and biological yield produced by the pre-basic Bakhtawar-92 seed (Stanelle *et al.*, 1988).

CONCLUSIONS AND RECOMMENDATIONS

It is concluded from the present study that seed categories of pre-basic, basic and certified of Bakhtawar-92 obtained from CCRI, Pirsabak performed better as compared to Fahri-Sarhad. Farmer's seed collected from different locations performed poor in all yield parameters. It is recommended that for maximum yield, farmers must try their best to obtain the basic, certified and approved seed categories of wheat from research station before sowing.

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