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Orignal Research Article

GENETIC DIVERSITY ASSAY OF THE LOCAL WHEAT VARIETIES AND CHINESE CROSSES FOR YIELD LINKED ATTRIBUTES UNDER LOCAL CONDITIONS

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Abstract: *To start a breeding strategy, breeder should make a selection of superior plants with the help of superior morphological characteristics in a segregating population. The breeder should have the knowledge about alleles with associated characters to yield and their inheritance pattern from one generation to another. The breeder should have the ability to choose the superior plant by phenotypically because phenotype is a true representative of genotype. The qualitative characters can be select on the base of the phenotype because these characters are controlled by one genes but phenotypic selection not reliable for quantitative characters because quantitative traits are controlled by more than one gene and environmental factors have great effect on them. For this purpose the nine crosses that were produced by the cross combination of four parental lines (XJ-22, XJ-23, XJ-24, XJ-25) previous year to study morphological parameters like plant height, length of spike, peduncle length, grains per spike, spikelets per spike, spike density, grain yield per spike, 1000-grain weight, tillers per plant and yield per plant.*

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Keywords: segregating population, wheat, qualitative traits, heterosis, grain yield

Introduction

Hybrids genotypes have more ability than their parental genotypes and have the ability for the production of new lines. Heterosis results due to allelic and non- allelic interaction in different environmental conditions. It's very variable in expression but it is common in many plant species(Timsina & Humphreys, 2006). Disease resistant, insect pest resistance, fertility and seed size increases by the proper combination of parents and it is due to heterosis(Kirigwi et al., 2004). Inbreeding depression cause decrease in the sustainability and viability of offspring in wheat crops but it is necessary to enhance crop yield in crossing mating layout(De Girolamo et al., 2017).Quantitative and genetic parameters information is important for the development of breeding methods and strategies. In this condition, for the desire selection in the plant breeding and genetics the transfer of traits from one generation to another helps in detecting the generation's actions(Kurt Polat et al., 2016). With the assistance of heritability information, information about genes can be identified and the gene of interest isolated. Detect the characteristics which are passed from parents to offspring. Heritability can be phenotypically calculated by gene effects. Small genetic and environmental changes would be more important in selection(Butler et al., 2005).

The important function is the division of total changes into phenotypic, genotypic and environmental factors and decides the effect of these features for specific characteristics description of the genetic changes form and thus help in developing a breeding protocol to boost the genetic characteristics(Purchase et al., 2000). Heritability calculation provide a parameter of character transfer from one parental line to the next, because suitability in selection performance depends on heritage portion of variability. Heritability estimates are usually more useful in estimating the genetic benefit under selection than heritability estimates alone. Genetic yield architecture can be best addressed by observing its component characteristics and provides guidelines for the selection of superior parents and for the rapid development in the systematic breeding programme suitable crosses combination to be used. Heterosis is the deviation of the F_1 hybrid combination's mean performance for a better parent or mid-parent value(Velu et al., 2012). The commercial development of hybrid varieties can be justified with a reasonable degree of heterosis, and in breeding system the study of heterosis will provide the basis for the hybrid combinations. For the improvement in grain production hybrid wheat system can play valuable role. Although Freeman had previously reported the role of heterosis in wheat in 1919, its large-scale use in the past years, was not known. Studies of heterosis will help to generate breeding strategies for the hybrid wheat development(Alam et al., 2013).

Objectives

The aim of this study is to estimate the mean performances of exotic genotypes in wheat crosses and to evaluate the potential of exotic genotypes over local varieties of wheat.

Materials and methods

I conducted this research in University of Agriculture Faisalabad's Department of Plant Breeding and Genetics to analyses mean performance of wheat yield components. The experiment was contained 3 replications. We used nine crosses of Chinese lines in this experiment. In one-meter-long rows, three replications of the nine crosses and three regional types were sowed. The experiment was sown with a dibbler at 9-inch intervals and 6 inch intervals inside each row. All agricultural procedures and safety precautions, including fertilizers, irrigation, and plant protection, were applied uniformly to the experimental population. The experimental plant was chosen at random among the experimental lines, and the data for the following attributes were gathered.

Height of plant, Tillers/plant, Spike length, Spikelets/spike, Grain/spike, Peduncle length, Density of spike, Grain yield/spike, weight of thousand grains, Plant yield

Statistical Analysis

According to the technique established by(Steel, 1997), the significance of the data was determined by employing analysis of variance for all of the parameters.

Results and Discussion

In this experiment data were collected for yield and various yield contributing parameters. Then the statistical techniques (analysis of variance) were applied to find the differences for all the parameters between all genotypes. The parameters height of plant, tillers per plant, length of spike, spikelets per spike, grains per spike, 1000 grain weight, peduncle length, spike density, grain yield per spike and yield per plant results of analysis of variances using nine Chinese crosses of exotic lines for morphological parameters is presented in table 1.

Table 1 Mean square ANOVA for traits studied in wheat genotypes using RCBD design

SOV	DF	HP	TP	LS	SS	GS	PL	SD	GYS	GW	YP
REP	2	18.01	2.06	3.95	2.39	49.35	1.74	0.03	0.062	18.13	2.07
GEN	11	202.50**	12.13**	9.12**	3.48**	127.16	36.98**	0.03**	1.41**	113.72**	152.98**
Error	22	6.870	3.1658	0.77	1.01	72.83	1.43	0.009	0.40	3.90	0.50

Plant Height (cm)

The crosses which were used in this experiment their plant height varied from 80.78 cm to 103.56cm but as compared to the local varieties there was difference in plant height. Maximum plant height (103.56 cm) was showed by cross XJ-25×XJ-23 and followed by XJ-24×XJ-25 (95.11cm), XJ-25×XJ-22 (95 cm) and minimum plant height value showed by XJ-23×XJ-25 (80.78). In local varieties, plant height varied from 84 cm to 108.33 cm. Maximum plant height (108.33 cm) was exhibited by line Johar-2016 followed by Faisalabad-2008 (104.67 cm) and minimum plant height was showed by the Ujala (84) as shown in fig 1. These results are similar with findings of(Ikhtiar& Alam, 2007).

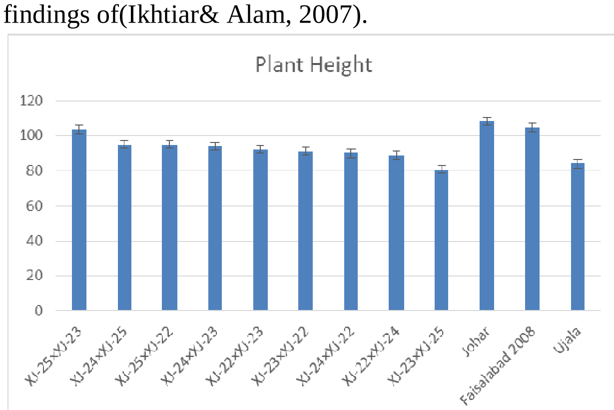

Fig.1: Mean performance for Plant Height of Chinese crosses and local varieties.

Tillers/Plant

Mean values of tillers per plant of crosses varied from 5.667 to 12.222. Among crosses, the maximum value for tillers per plant was showed by the XJ-22×XJ-24 (12.222). Overall this cross performance was not good in other parameters but in this trait it showed maximum value as compared to the other crosses and followed by the XJ-25×XJ-23 (12), XJ-23×XJ-22 (11.778) and XJ-22×XJ-23 (11.111). The minimum value for the tillers per plant was showed by the XJ-23×XJ-25 (5.667) and this cross showed overall minimum values in parameters. Mean values for tillers per plant of local varieties varied from 7.333 to 11. The maximum value for the tillers per plant was showed by the Ujala (11) followed by Faisalabad 2008 (9). Minimum value for the tillers per plant was revealed by the Johar (7.333) as shown in fig 2 similar results were found by (Iqbal et al., 2007).

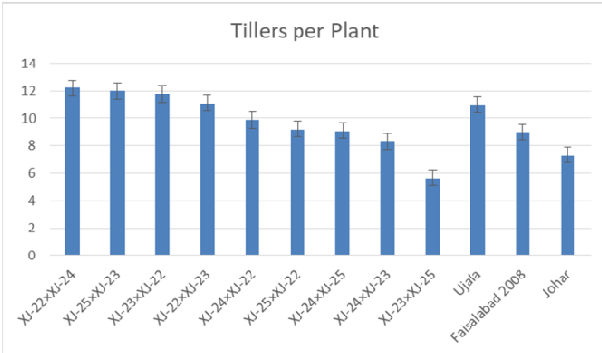

Fig.2: Mean performance for Tillers per Plant of Chinese crosses and local varieties.

Spike length (cm)

Spike length among crosses varied from 13 cm to 15.167 cm. Measured spike length at stage of maturity. The maximum measured value for spike length was shown by the cross XJ-23×XJ-22 (15.167) followed by the XJ-25×XJ-23 (14.056) and XJ-22×XJ-23 (14 cm). In previous parameters the maximum values showed by the two different crosses but maximum value for the length of spike showed by another cross. This showed that the different crosses showed maximum values for different traits. The spike length relate with the grain yield that the maximum spike length has more number of spikelets and more number of grains produce and increases grain yield overall. The minimum spike length was showed by XJ-24×XJ-23 (13 cm). The spike length among the local lines varied 8.5 cm to 12.167 cm. Maximum spike length was shown by the Johar (12.167 cm) followed by Faisalabad 2008 (11.167 cm). In comparison, the local varieties have low length of spike as compare to the crosses. The minimum spike length was shown by the Ujala (8.5 cm) as shown fig 3. These results are similar with findings of (Chandio & Jiang, 2018).

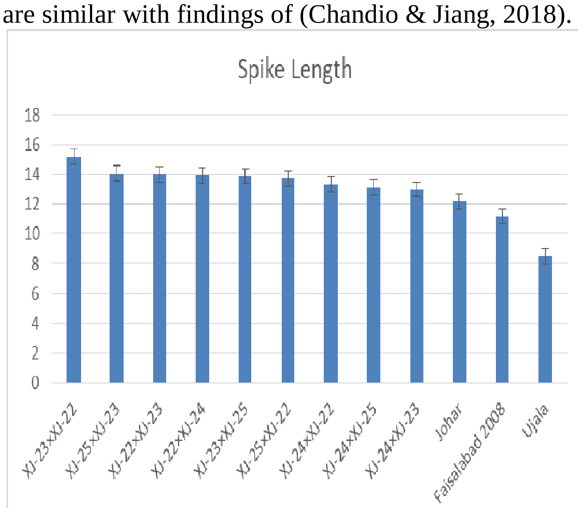

Fig.3: Mean performance for Spike length of Chinese crosses and local varieties.

Spikelet/Spike

As the spike length is maximum the number of spikelets per spike also varies. Counted the number of spikelets per spike of the main spike excluding the sterile spikelets on the lower side of the spike. The counted mean values of spikelets per spike for crosses varied from 21.889 to 24.111. Among crosses, maximum spikelets per spike were showed byXJ-25×XJ-22 (24.111) followed by XJ-24×XJ-23 (23.222) and XJ-24×XJ-25 (23.111). Minimum value of spikelets per spike was showed by XJ-23×XJ-25 (21.889). Mean values of spikelets per spike among local varieties varies from 19.667 to 22.333. The maximum number of spikelets per spike value was showed by the Faisalabad 2008 (22.333) and Ujala (22.333). The minimum value of number of spikelets per spike was showed by the Johar (19.667) and in comparison, the crosses showed high values for spikelets per spike as shown in fig 4. These results are similar with findings of (Munazir et al., 2010; Shah et al., 2009).

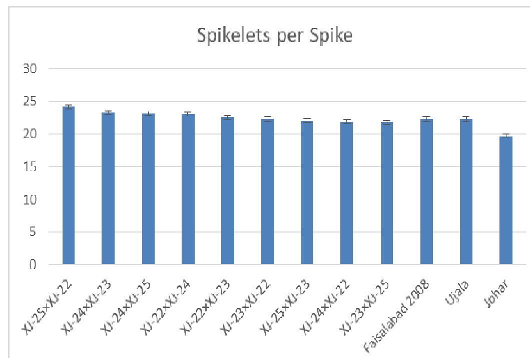

Fig.4: Mean performance for Spikelets per Spike of Chinese crosses and local varieties.

Number of Grain/Spike

The main spike of the mother plant tiller was harvested and threshed manually and grains per spike was counted. Mean values for grains per spike of crosses were found in range of 62.553 to 80.217. Among crosses, maximum grains per spike were revealed byXJ-25×XJ-22 (80.217). As this cross showed maximum number of spikelets per spike in previous parameter and showed high value for this parameter also. On the second number the crosses showed high values were XJ-24×XJ-23 (74.22), XJ-23×XJ-22 (72.217), XJ-22×XJ-23 (71.107). The minimum value for the grains per spike was showed by the XJ-24×XJ-22 (62.553). This cross also showed minimum number of spikelets per spike. Mean value for grains per spike of local varieties varied from 55.167 to 70. The maximum value was showed by the Faisalabad 2008 (70) and high value for the spikelets per spike was also showed by this variety and second high value showed by Ujala (63.133). The minimum value of number of grains per spike was showed by the Johar (55.167). Overall comparison showed that the crosses have high values then the local verities as shown in fig 5. These results are similar with findings of (Afzal et al., 2007).

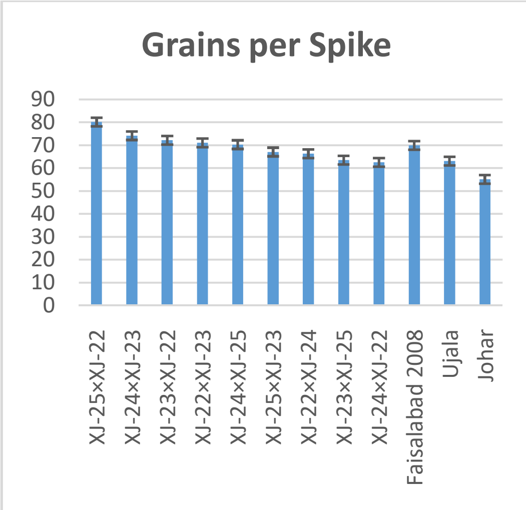

Fig.5: Mean performance for Grains per Spike of Chinese crosses and local varieties.

Peduncle length

Measured the peduncle length of main tillers of the plants. The mean values for peduncle length among crosses were found in range from 8.22 cm to 17.056 cm. Maximum peduncle length was revealed by XJ-25×XJ-23 (17.056 cm) followed byXJ-25×XJ-22 (13.725 cm). As in plant height this crosses also showed maximum value. The minimum peduncle length was revealed by the XJ-23×XJ-25 (8.22cm). As we measured peduncle length for local varieties, mean values varied from 21.33 cm to 15.200 cm. Among local varieties Faisalabad 2008 (21.33 cm) exhibited maximum peduncle length followed by Johar (17.267 cm) but the maximum plant height was showed by the Johar-2016. The minimum peduncle length was showed by the Ujala line (15.200 cm) as shown in fig 6. Similar results were find by (Ahmad et al., 2001).

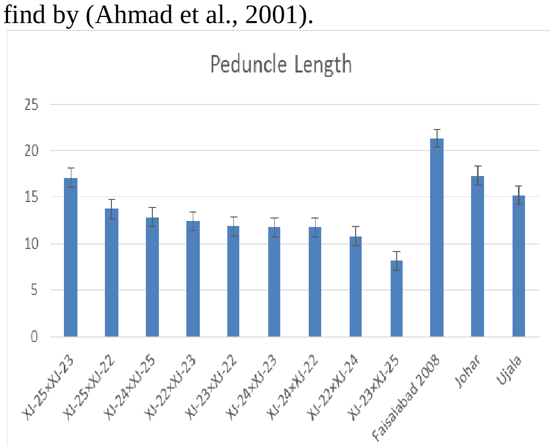

Fig.6: Mean performance for Peduncle length of Chinese crosses and local varieties.

Density of spike

Mean values for spike density of crosses varied from 1.5213 to 1.8132. Among crosses, maximum value for spike density was observed for XJ-24×XJ-23 (1.8132) and minimum spike length was also showed by this cross. This cross also showed maximum value for the plant height and overall showed better values for the other parameters but it showed maximum density of spike as compared to the other crosses which showed maximum values for the other parameters. On second number high vales showed by XJ-24×XJ-25 (1.7789) and XJ-25×XJ-22 (1.7612). The minimum value for spike density was showed by the XJ-23×XJ-22 (1.5213) as the maximum spike length was showed by this cross. For local lines, spike density varied from 1.7759 to 1.8360. Among local lines, maximum spike density was observed for Faisalabad 2008 (1.8360) followed by Johar (1.7910). The minimum spike density value for the local lines was showed by the Ujala (1.759) as shown in table 4.2 and fig 7. These results are similar with findings of (Ali et al., 2010; Joshi et al., 2017).

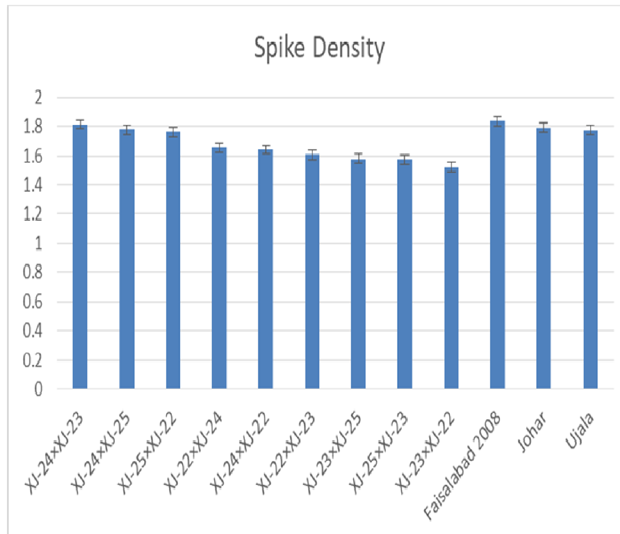

Fig.7: Mean performance for Spike Density of Chinese crosses and local varieties.

Grain yield/spike (g)

Grain yield is a main parameter of the plant. Measured the grain yield per spike by harvesting the main spike of the plants and harvest manually and measured weight of grains by help of electric balance. Mean values for grain yield per spike of crosses varied from 1.55g to 3.6633g. Among crosses, maximum grain yield per spike (3.6633 g) was shown by cross XJ-25×XJ-22. This cross also showed high values for the spikelets per spike and number of grains per spike and the other cross showed high values were XJ-22×XJ-23 (3.22 g) and XJ-24×XJ-23 (2.6633 g). The minimum mean value for grains yields per spike was showed by the XJ-23×XJ-25 (1.55 g). Mean values for the grain yield per spike of local lines varied from 2.6333g to 2.9g. Maximum value for grain yield per spike was showed by the Faisalabad 2008 (2.9g) followed by Johar (2.9g). The minimum value for the grain yield per spike was showed by the Ujala (2.6333g) as shown in fig 8. These results are similar with findings of (Hussain et al., 2006).

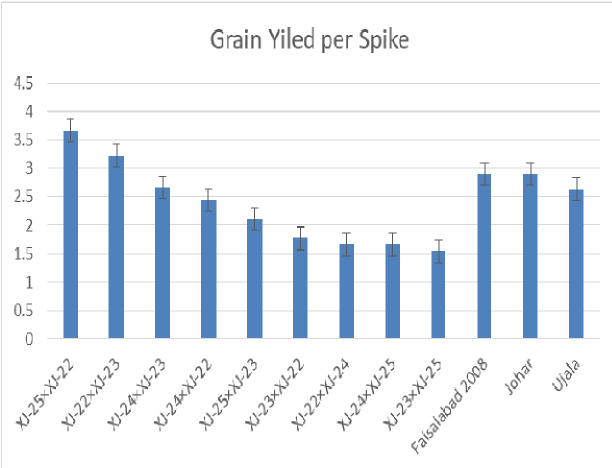

Fig.8: Mean performance for Grain Yield Spike of Chinese crosses and local varieties.

Weight of thousand grains

Thousand grain weight is important trait of the plant and it was measured by counting one thousand grain of the plant and weighing it by help of the electric balance. The measured mean values of 1000-grain weight of crosses varied from 25.333g to 37g. Among crosses, maximum value for 1000-grain weight was observed for XJ-25×XJ-22 (37 g). This cross also showed maximum values for the spike length, spikelets per spike, and grains per spike and also showed high value for this trait. The other crosses which showed high values were by XJ-24×XJ-23 (35g) and XJ-25×XJ-23 (32.667g). The minimum value for the 1000 grain weight was showed by the XJ-23×XJ-25 (25.333g). For local lines, 1000-grain weight varied from 38.167g to 44g. The maximum value for the thousand grain weight was showed by the Faisalabad 2008 (44g) followed by Johar (42.133g). The minimum value for thousand grain weight was revealed by the Ujala (38.167g). In comparison, the local varieties showed high values for the thousand grain weight and Faisalabad-2008 showed overall good values for all other traits as shown in fig 9.

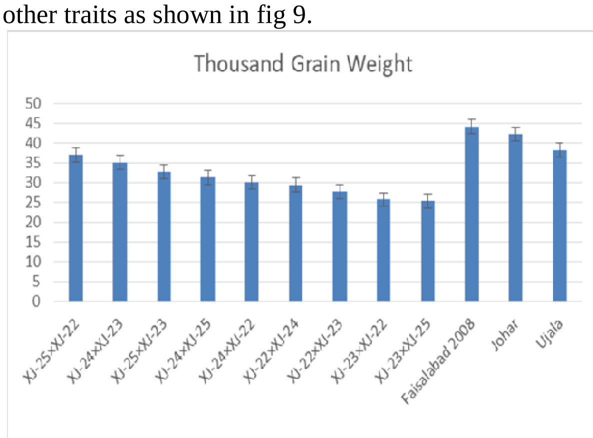

Fig.9: Mean performance for Thousand Grain Weight of Chinese crosses and local varieties.

Yield/Plant (g)

Yield per plant is main parameter of this experiment. The varieties which showed high yield per plant are more important for further use. Yield parameter was calculated by weighing the grains of the plant by electric balance and mean values of yield per plant of crosses varied from 8.440g to 12.330g. Among crosses, the maximum value for yield per plant revealed by the XJ-25×XJ-22 (12.330g). It showed maximum values for the spikelets per spike, grain yield per spike and thousand grain weight. The other crosses which showed high values were XJ-24×XJ-23 (11.663g), XJ-25×XJ-23 (10.883). The minimum value for yield per plant of crosses was showed by the XJ-23×XJ-25 (8.440g). It also showed minimum values for grain yield per spike and thousand grain weight. For local varieties, the value for the yield per plant varied from 22.233g to 28.267g. Maximum value revealed by the Ujala (28.267g) followed by the Faisalabad 2008 (25.9g). Minimum value for yield per plant was showed by the Johar (22.233g). As compared to the crosses the local varieties showed maximum yield production as shown in fig 10.

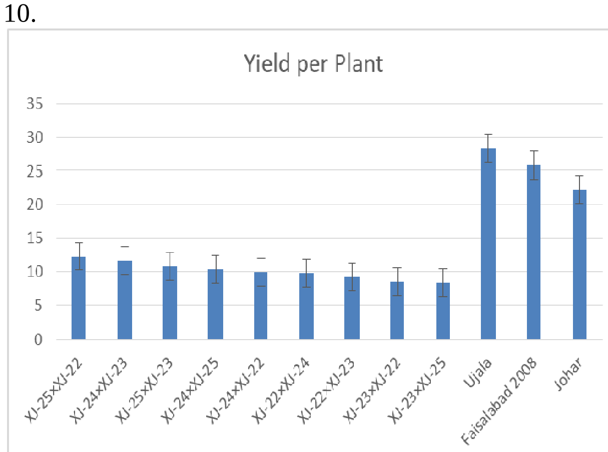

Fig.10: Mean performance for Yield per Plant of Chinese crosses and local varieties.

Conclusion

Then mean data of entirely parameters studied that are stated above were more analyzed through least significant difference (LSD) test. This showed the significant and nnon significant difference in studied parameters of nine wheat crosses and three Wheat Genotypes. Among wheat crosses XJ-25×XJ-22 showed maximum results for grains per spike, grain yield per spike, spikelets per spike, thousand grain weight and yield per plant. XJ-24×XJ-23 showed maximum results for spike density. XJ-25×XJ-23 showed maximum results for plant height and peduncle length. XJ-23×XJ-22 showed maximum results for spike length and XJ-22×XJ-24 showed maximum results for tillers per plant. Among Wheat Genotypes Faisalabad 2008 showed better results as compared to the ujala and johar for grains per spike, grain yield per spike, peduncle length, spike density, spikelets per spike and thousand grain weight but johar results were better for spike length and plant height and ujala was good for tiller per plant and yield per plant.

Conflict of interest

The authors declared absence of conflict of interest.

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