Zagazig J. Agric. Res., Vol. 48 No. (5) 2021 1197-1214

Plant Production Science

Available online at http://zjar.journals.ekb.eg
http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

DETERMINATION OF GENETIC PURITY AS AFFECTED BY SEED SOURCES IN FOUR BREAD WHEAT VARIETIES

Mohamed E.S. Kammoura[1*], A.A.G. Ali[2], H.A. Awaad[2] and M.I. Elemery[1]

1. Seed Technol. Res. Section, Field Crop Res. Inst. ARC, Giza, Egypt

2. Agron. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 29/09/2021 ; Accepted: 30/10/2021

ABSTRACT: Seed categories and crop varieties play an important role in wheat production in Egypt, which effect on genetic purity of wheat genotypes. So, this investigation aimed to study the effect of seed sources and varieties on yield and its attributes. Two field experiments were conducted at the Experimental Farm of Giza Agricultural Research Center (ARC), Giza Governorate, Egypt, during two successive winter growing seasons of 2014/2015 and 2015/2016 on the optimum sowing date 15th of November. Four wheat varieties (Misr1, Gemmeiza 11, Giza 168 and Sids 12) and their seed categories (Basic, Certified and Farmer saved seeds) were used in this study. Yield and its attributes and off- type percentage were estimated in the field experiment, further more phenol color reaction and ISSR technology were carried out at Seed Technology Department Laboratory. The results indicated significant differences between wheat varieties and its seed categories for the most traits. Gemmeiza 11 variety gave the highest value in most studied traits *i.e*., flag leaf chlorophyll content SPAD, flag leaf area, spike length, No of spikes/m^2, No of grains/spike, 1000-grain weight and grain yield/fad., while the lowest value of those traits were recorded by Misr 1 variety. For the effect of seed categories on yield and yield attributes, basic seeds gave the greatest value for all characters, except for plant height where farmer seed recorded the highest value. Meanwhile insignificant effects were obtained from seed categories on flag leaf chlorophyll content SPAD. The interaction effects between varieties and seed categories indicated that Gemmeiza 11 and Sids 12 varieties with Basic and Certified seed categories gave the highest value of most traits, while Misr 1 Varity with farmer seed category gave the lowest value for yield traits. Insignificant effects were noticed between wheat varieties for the off- type % while seed categories showed highly significant effects where, Farmer saved seed recorded the highest value and Basic seed gave the lowest value for this trait. Wheat varieties showed different color reaction to phenol while seed categories took the same pattern in phenol color reaction for each variety. Eight ISSR primers were used for fingerprinting the four wheat varieties and their seed categories produced 97 band, 31 of them were polymorphic (68.04%) polymorphism. The highest level of polymorphism was observed in primer HB-12 which showed 95.00% polymorphism, while the lowest polymorphism was 28.57% in primer HB-09.

Key words: Wheat, seed category, phenol test, ISSR,

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important nutritional cereal crops in Egypt and all over the world. Increasing production per unit area appears to be one of the important factors for narrowing the gap between production and consumption. Egypt's area of wheat is estimated by about 3.4 million faddan with production of 8.9 million ton, while it imports 10 million tons of wheat (**FAO STAT, 2020/ 21**). Seed categories and varieties play an important role in wheat production in Egypt. Improved varieties and its seed quality are the key good agriculture progress. High degree of

*** Corresponding author: Tel. :**+201225595291
E-mail address: kammoura@icloud.com

genetic variability was recorded between five wheat genotypes *i.e*., Gemmeiza 7, Sakha 93, Giza 168, Gemmeiza 9 and Sids13 in flag leaf area, plant height, spike length, number of grains/spikes, 1000–grain weight and biological yield/plant. Not enough foundation (basic) seed could be produced to sowing all the areas allocated to production of registered seed **(Attia *et al*., 2015)**. Therefore, the genetic composition of the variety initially developed by the breeders must be the same as marketed to the grower after several generations. It means that genetic purity of varieties must be found in every class of seed certification program which included breeder seed, basic seed, registered seed and certified seed **(Amal, 2004). Khan *et al*. (2007)** found that pre-basic category of Bakhtawar-92 obtained from CCRI, Pirsabak gave the maximum spikes/m^2 (347.3), grains/spike (52.30), 1000-grain weight (52.75 g), grain yield (4931 kg ha-1), followed by basic and certified categories of the same cultivars and location. Grain yield and genetic purity based on number of off-types and seed fingerprint were significantly reduced from planting farmer-saved seeds compared with basic, registered and certified seeds. So, it is possible to utilize farmer-saved seed for one year of certified seed provided that the farmer takes out the off-types from the part of the field and keep it for next planting **(El-Kalla *et al*., 2010)**. **Muhammad *et al.* (2012)** indicated that number of fertile tillers/ m^2 were significantly higher in certified seed source than the farmer's own seed that resulted in significant increase in grain yield. Other yield contributing parameters including number of spikelet/spikes, numbers of grains/spike and 1000 grain weight were at par in both seed sources. Therefore, healthy and pure seed source gave high seed germination and good crop stand which enabled the plants to withstand abiotic stress especially drought during the crop season. The average physical purity of seed obtained from the formal sector was 99.41% compared with seed obtained from the informal sector, e.g., neighbors/other farmers, traders / markets, or own saved seed. The formal sector seed had the highest analytical purity and lowest mean contamination of other crop seeds and noxious weeds where all samples met the standard for certified seed **(Bishaw *et al.*, 2012)**. **Arif *et al.* (2015)** suggested that there is the need for strengthening agricultural extension services in the study area in order to educate the farming community to ensure the use of recommended certified seed and modern agriculture technology for getting high yield of wheat crop.

Generally, there was virtually no difference about physiological quality between certified seed and farm-saved seed sector that is related to lower quality of certified seed. The certified produced seeds had the lower number of weed seed, species and genus before and after cleaning. The highest seed purity and 1000 seed weight was obtained from the certified seed production system. The need for cleaning the farm-saved seed samples before sowing is one of the important findings of this survey **(Khazaei *et al.*, 2016)**. Meanwhile, **Duric *et al.* (2016)** indicated that genotype PKB Lepoklasa and seed category pre-basic seed had the highest values for the largest number of yield traits, while the genotype BG Merkur and the certified seed of the first generation had the lowest values. Furthermore, Certified seed categories of the first generation and basic seed had similar reactions to the interaction between factors. The use of uncertified seed by farmers contributed to high disease incidence **(Tenge *et al.*, 2016**). **Adinew and Mohmmed (2019)** showed that the interaction of seed source and variety had significant effect on all physical and physiological seed quality parameters. **Alemu (2019)** found that seed source influenced growth and yield during the growing season but the response depended on seed size and variety. The source of seed can also be important since location influences seed nutrient content. Number of tillers were significantly affected by main effect of variety, seed source and seed rate. Interaction effect of variety and seed source has highly significant effect on number of tillers per 1 m length.

Survey off-types in certified and farm-saved seed samples to compare varietal purity based on type of seed producer and IR wheat history was performed by **Gaines *et al.* (2007).** Ninety-two samples of non-IR varieties were taken from certified and farm-saved seed growers. One certified sample and three farm-saved samples exceeded the 0.1% threshold for off-types in certified wheat seed. Laboratory testing including phenol test of the seed came the same conclusion. **Squires *et al*. (2014)** implied three primary sources for seeds of off-type colour *i.e.,* admixtures of genetically different varieties, true-to-type varieties and the last source of variation was attributed to unknown environmental interactions in genetically pure samples. A variety of phenol reactions among the wheat species having different genomes were detected by (**Niranjana *et al*., 2018)**. **Pavlic *et al*. (2018)** used phenol method according to **UPOV (1994)** guidelines for DUS testing on 40 different wheat genotypes. Grain color was determined according to the coloration grade, on a scale from 0 to 9. All genotypes showed certain degree of pericarp coloration. Coloration grades were from 1 (one genotype) to 9 (12 genotypes), 32.5% of genotypes were scored as medium low to very low coloration of grain.

ISSR have been successfully used to assess the genetic diversity of wheat varieties. The genetic relationships estimated by the polymorphism of ISSR markers revealed greater level of genetic variability in wheat accessions of wide adaptability and applicability **(Singh and Jaiswal, 2016; Heidari *et al*., 2017; Mandoulakani *et al*., 2017).** The present investigation aimed to evaluate seed degree (Basic-Certified and Farmer-saved seed) of four varieties under field and laboratory conditions and determine the importance of seed source and to assure the quality seed.

MARTIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Giza Agricultural Research Center (ARC), Giza Governorate, Egypt, during the two successive winter growing seasons of 2014/2015 and 2015/2016 on the optimum sowing date 15^{th} of November.

The field experiments were laid out in split plot design with four replications. The main plots were devoted to four wheat varieties *i.e.*, Misr1, Gemmeiza11, Giza168 and Sids12 and the sub plots devoted to three seed categories or classes i.e. (Basic, Certified and Farmer-Saved seed). Sup plot area was 3.6 m^2 contain 6 rows, 3 m long; raw to raw was 20 cm. The soil was clay in texture. All recommended cultural practices were applied. Random sample of ten guarded plants were taken from each sup plot to estimate; morpho-physiological characters *i.e.*, flag leaf chlorophyll content (SPAD) using chlorophyll meter (SPAD-502 Soil Plant Analysis Development (SPAD)Section Minolta Camera Co, Oska, Japan), flag leaf area cm^2, plant height (cm) and spike length (cm). Yield and its components *i.e*., number of spikes/m^2, number of grains/spike and 1000- grain weight (g) was estimated. Grain yield (Kg/fad) was determined from a center area (4 rows) of each sub plot.

Off Type Percentage

was estimated by divided the number of off-type plants by the total number of plants of every seed category for the studied varieties following the standard of the Seed Testing and certification administration, Ministerial Decree, 368 (1998),

Phenol Color Reaction

Four random replicates, each of 100 grains, were placed on germination paper lemming Petri dish large enough to accommodate each replicate. Phenol solution at 1% was used as watering media. Change in grains color was recorded at one, two, three and four hours, according to **Banerjee and Chandra (1974)**.

Analysis of Inter Simple Sequence Repeats (ISSR)

The Genomic DNA was extracted using DNeasy Plant Mini Kit (QIAGEN) from young leaves. The PCR was performed using a set of eight primers which are presented in Table 2. The reaction was performed in 30-µl volume tubes according to **Williams *et al*. (1990)**. The reaction mixture included 3 µl dNTPs, 3 µl $MgCl_2$, 3µl Buffer (10 x), 2 µl primer (10 pmol), 0.2µl Taq DNA polymerase (5U/µl), 2 µl Template DNA (25 ng) and 16.8 µl H_2O (D.W.). The DNA amplifications were performed in an automated thermal cycle (model Techno 512) programmed for one cycle at 94º C for 4 min followed by 45 cycles of 1 min at 94º C, 1 min at 57º C, and 2 min at 72º C, and the reaction was finally stored at 72º C for 10 min.

Agarose (1.50 gm) was mixed with (100 ml) l × TBE buffer and boiled in the microwave. The ethidium bromide (5 µl) was added to the melted gel after the temperature became 55°C. DNA amplified product (15 µl) was loaded in each well. DNA ladder (100 bp) mix was used as standard DNA with molecular weights of 3000, 1500, 1000, 900, 800, 700,600, 500, 400, 300, 200 and 100 bp. The run was performed for about 30 min at 80 V in a mini-submarine gel Bio-Rad.

Table 1. Allowable off- types in different seed categories according to the Ministerial Decree No. 368 of 1998 setting seed testing standards and procedures for certification

	Breeder	Basic	Certified
Off types allowable	0 %	0 %	1 %
Percentage %	0: 10.000	0: 10.000	1: 100

Table 2. List of ISSR primers and their nucleotide sequences used in the study

No.	Name	Sequence	No.	Name	Sequence
1	14A	5′-CTCTCTCTCTCTCTCTTG-3`	5	HB-10	5′-GAGAGAGAGAGACC-3`
2	44B	5′-CTCTCTCTCTCTCTCTGC-3`	6	HB-12	5′-CACCACCACGC-3`
3	HB-8	5′-GAGAGAGAGAGAGG-3`	7	HB-13	5′-GAGGAGGAGC-3`
4	HB-9	5′-CACCACCACGC-3`	8	HB-15	5′-GTGGTGGTGGC-3`

Data Analysis

The similarity matrices were done using Gel works ID advanced software UVP-England Program. The relationships among varieties as revealed by dendrograms were done using SPSS windows (Version 10) program. DICE computer package was used to calculate the pairwise difference matrix and plot the phenogram among genotypes **(Yang and Quiros, 1993)**.

All characters were subjected to analysis of variance (ANOVA) to test the significance of variance sources using XLSTAT2016.05. Combined analyses between the two seasons were conducted, and the least significant difference (LSD) values were calculated at the 5% and 1% probability levels **(Steel and Tonle, 1997)**.

RESULTS AND DISCUSSION

Morpho-Physiological Characters

The statistical analysis of flag leaf chlorophyll content (SPAD), flag leaf area, plant height and spike length for wheat varieties during the two seasons and combined are listed in Tables 3 and 4.

Effect of varieties

Statistical analysis of variance revealed highly significant differences between varieties for morpho-physiological characters. These results indicated the presence of adequate amount of genetic differences between wheat varieties for these traits**.** Sids 12 variety recorded the greatest value of flag leaf chlorophyll content (SPAD) followed by Gemmeiza 11 in both seasons and its combined (Table 2), while the lowest flag leaf chlorophyll content (SPAD) was recorded by Misr 1 then Giza 168. Whereas the latest " Giza 168" variety had the broadest flag leaf area (cm^2) followed by Gemmeiza 11 and Sids 12 varieties in the two seasons and it’s combined without any significant differences between them, while the narrower flag leaf area (cm^2) was recorded by Misr1 (Table 2). **Awaad *et al*. (2010)** and **Abaza *et al.* (2020)** recorded significant difference between some wheat varieties in respect to flag leaf chlorophyll content. **Attia *et al.* (2015)** found significant differences in flag leaf area between five wheat varsities. The maximum flag leaf area was produced from Sakha 93 (24.00 cm^2) , but the lowest flag leaf area (14.68 cm^2) was resulted from Sids 13.

Gemmeiza 11 appeared to produce taller plants and longer spikes in both seasons and its combined. Meanwhile, Sids 12 was the shortest plant height and Misr 1 behaved the same in spike length (cm) through the two seasons and their combined (Table 3) compared with the other evaluated wheat varsities. **Abd El-Rahman and El-Saidy (2016)** indicated significant differences between wheat genotypes in plant height, and Sids 12 was the shortest compared with other genotypes. **Attia *et al.* (2015)** found significant differences between wheat genotypes Gemmeiza 11, Sakha 93, Giza 168, Gemmeiza 9 and Sids13 in spike length.

Effect of seed categories

As shown in Table 3 results indicated insignificant differences between seed categories in both seasons and the combined for flag leaf chlorophyll content (SPAD). Meanwhile basic seeds category achieved the broadest value of flag leaf area (cm^2) followed by certified seed category, while farmer seed category had the lowest one for flag leaf area (cm^2) in both season and their combined. Otherwise, **Khazaei *et al.* (2016)** reported that no differences about physiological quality between certified seed and farm-saved seed sector that was related to the lower quality of certified seed. Moreover, the highest plant height was observed in farmer seed categories, while the shortest one was recorded by basic and certified categories without any significant differences between them (Table 4).

The attained results in Table 4 displayed significant differences between seed categories in spike length in the 1st season and highly significant differences in the 2nd one and the combined. Basic seeds had the longest spike length in two seasons and it's combined without significant differences with certified seeds in the 1st season, while the farmer seeds category had the shortest spike length in the two seasons and their combined. **Shahwani *et al.* (2014)** stated that plant height and spike length were affected significantly by seed size.

Effect of interaction

Regarding the effect of interaction between wheat varieties and seed categories on flag leaf chlorophyll content (SPAD), highly significant effects were noticed in the 1st season, while it was insignificant in the 2nd one and the combined analyses.

In the light of highly significant interaction effects between wheat varieties and seed categories in the 1st season on chlorophyll content, results given in Table 3-a indicated that Sids 12 variety with all wheat seed categories and Gemmeiza 11 variety with basic and certified seed categories gave the higher value of flag leaf chlorophyll content. On the other hand, the lower value of flag leaf chlorophyll content was obtained by Giza 168 with certified and farmer saved seed categories.

Highly significant interaction was found between wheat varieties and their seed categories for flag leaf area in the 1st, 2nd seasons and their combined. As given in Table 3-a during the 1st season, Gemmeiza 11 and Sids 12 varieties with basic seed category gave broadest flag leaf area (61.98 cm^2) and (60.90 cm^2), respectively. Whereas, Misr1 with farmer seed category gave the narrower flag leaf area (47.85 cm^2). In the 2nd season (Table 2-b), the higher value of flag leaf area (55.98 cm^2), (54.90 cm^2) and (54.53 cm^2) were achieved by Gemmeiza 11, Sids 12 and Giza 168 varieties with basic seed category, respectively. On the other direction, the lowest value of flag leaf area (41.85 cm^2) was recorded by Misr1 with farmer seed category. Based on the combined (Table 2-b), the higher estimates of flag leaf area 58.98, 57.90 and 57.53 cm^2 were attained by Gemmeiza 11, Sids 12 and Giza 168 varieties with basic seed category, respectively. Whereas the lowest flag leaf area 44.85 cm^2 was registered by Misr 1 with farmer seed category.

Highly significant interaction between the two studied factors in two seasons and its combined were found on plant height. During the 1st season, as illustrated in Table 3-a, the tallest plant height 109.65 cm was achieved by Gemmeiza 11 with farmer seed category, while the shortest plant height (93.13 cm) was found by Sids 12 with farmer seed category. In the 2nd season (Table 4-a), the tallest plant height (125.97 cm) has been achieved by Gemmeiza 11 with farmer seeds. On the other hand, the shortest plant height (102.70 cm) was recorded by Sids 12 with farmer seed category. Based on combined analyses, results of Table 3-a revealed that the tallest plants (115.76 cm) were registered by Gemmeiza 11 with farmer seed category, whereas the shortest plants (96.76 cm) were registered by Sids 12 with same category.

Spike length display insignificant interaction in the two seasons and significant in the combined (Table 4-b). According to combined analysis (Table 4-b), the longest spike length 14.19 cm and 13.59 cm were achieved by Gemmeiza 11 and Sids 12 varieties with basic seed category. While, the shortest spike length (10.90 cm) was recorded by Misr 1 variety with farmer seed category, this result refers to the deterioration happened in seed propagation process.

Table 3. Mean performance of flag leaf chlorophyll content (SPAD) and flag leaf area (cm^2) for some wheat varieties under three seed categories during two successive seasons (2014-2015 and 2015-2016) and their combined

Main effect and interaction	Flag leaf chlorophyll content (SPAD)			Flag leaf area (cm^2)		
	2014-2015	2015-2016	Combined	2014-2015	2015-2016	Combined
Varieties						
Misr 1	46.85 c	47.19 b	47.02 c	52.52 c	46.52 c	49.52 c
Gemmeiza 11	50.41 b	50.11 a	50.26 b	57.58 ab	51.58 ab	54.58 ab
Giza 168	46.44c	45.99 b	46.22 d	58.41 a	52.41 a	55.41 a
Sids 12	53.02 a	51.78 a	52.40 a	57.01 b	51.01 b	54.01 b
F- test	**	**	**	**	**	**
Seed categories						
Basic seed	49.48	49.46	49.47	60.28 a	54.28 a	57.28a
Certified seed	49.44	48.56	49.00	55.54 b	49.54 b	52.54b
Farmer seed	48.61	48.29	48.45	53.32 c	47.32 c	50.32c
F-test	NS	NS	NS	**	**	**
Interaction	**	NS	NS	**	**	**

NS and ** indicated insignificant and significant at 0.01 level of probability, respectively.

Table 3-a. Flag leaf chlorophyll content (SPAD) and flag leaf area (cm^2) as affected by the interaction between wheat varieties and seed categories (1st season)

Varieties / Seed categories	Flag leaf chlorophyll content (SPAD) (1st season)				Flag leaf area (cm^2) (1st season)			
	Misr1	Gemmeiza 11	Giza 168	Sids 12	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic seed	B	A	B	A	C	A	B	AB
	47.00 a	52.13 a	47.08 a	51.73 b	57.70 a	61.98 a	60.53 a	60.90 a
Certified seed	B	A	B	A	C	A	B	A
	46.55 a	52.00 a	46.13 a	53.10 a	52.00 b	58.03 b	55.20 b	56.93 b
Farmer seed	B	B	B	A	C	B	A	B
	47.00 a	47.10 b	46.13 a	54.23 a	47.85 c	52.73 c	59.50 a	53.20 c

Table 3-b. Flag leaf area (cm^2) as affected by the interaction between wheat varieties and seed categories (2nd season and combined)

Varsities / Seed categories	Flag leaf area (cm^2) (2nd season)				Flag leaf area (cm^2) (combined)			
	Misr1	Gemmeiza 11	Giza 168	Sids 12	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic	C	A	A	AB	C	A	B	B
	51.70 a	55.98 a	54.53 a	54.90 a	54.70 a	58.98 a	57.53 a	57.90 a
Certified	C	A	B	A	D	A	C	B
	46.00 b	52.03 b	49.20 b	50.93 b	49.00 b	55.03 b	52.20 c	53.93 b
Farmer Seeds	C	B	A	B	D	C	A	B
	41.85 c	46.73 c	53.50 a	47.20 c	44.85 c	49.73 c	56.50 b	50.20 c

Table 4. Mean performance of plant height(cm) and spike length (cm) for some wheat varieties under three seed categories during two successive seasons (2014-2015 and 2015-2016) and their combined

Main effect and interaction	Plant height (cm)			Spike length (cm)		
	2014-2015	2015-2016	Combined	2014-2015	2015-2016	Combined
Varieties						
Misr 1	102.88 a	111.62 b	107.25 b	11.17 d	11.16 c	11.16 c
Gemmeiza 11	106.00 a	117.13 a	111.57 a	13.75 a	13.56 a	13.65 a
Giza 168	98.38 c	107.23 c	102.81 c	12.29 c	12.14 b	12.22 b
Sids 12	96.28 d	104.50 d	100.39 d	13.03 b	13.63 a	13.33 a
F- test	**	**	**	**	**	**
Seed categories						
Basic seed	100.37 b	109.27 b	104.82 b	12.62 ab	13.13 a	12.87 a
Certified seed	99.49 b	108.66 b	104.08 b	12.75 a	12.51 b	12.63 b
Farmer seed	102.81 a	112.42 a	107.61 a	12.31 b	12.23 b	12.27 c
F- test	**	**	**	*	**	**
Interaction	**	**	**	NS	NS	*

NS, * and ** indicated insignificant, significant at 0.05 and 0.01 levels of probability, respectively.

Table 4-a. Plant height (cm) as affected by the interaction between wheat varieties and seed categories (1st, 2nd season and combined)

Varieties / Seed categories	Plant height (1st season)				Plant height (2nd season)				Plant height (combined)			
	Misr1	Gemmeiza 11	Giza 168	Sids 12	Misr1	Gemmeiza 11	Giza 168	Sids 12	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic seed	A	A	B	B	A	A	B	B	A	A	C	B
	105.10 a	103.53 c	95.95 b	96.90 b	117.91 a	116.87 b	106.73 b	107.90 a	109.46 a	108.72 c	100.01 b	101.10 a
Certified seed	B	A	C	B	BC	A	C	B	B	A	C	B
	98.15b	104.83 b	96.15 b	98.83 b	108.42 b	118.69 b	196.34 b	109.07 a	102.54 b	110.21 b	100.24 b	103.31 a
Farmer Seed	B	A	C	D	B	A	C	D	B	A	C	D
	105.40 a	109.65 a	103.05 a	93.13 c	118.04 a	125.97 a	115.18 a	102.70 b	109.75 a	115.76 a	108.17 a	96.76 c

Table 4-b. Spike length (cm) as affected by the interaction between wheat varieties and seed categories (combined)

Varieties / Seed categories	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic seed	D	A	C	B
	11.33 a	14.19 a	12.32 a	13.59 a
Certified seed	D	A	C	B
	11.26 ab	13.88 b	12.09 b	13.30 b
Farmer seed	C	A	B	A
	10.90 b	12.90 c	12.18 ab	13.10 b

Yield and its Components

The statistical analysis of variance for wheat grain yield and its components for wheat varsities, their seed categories and interaction between them are tabulated in Tables 5 and 6.

Effect of varieties

The results show insignificant during the two seasons and significant differences between wheat varieties for No. of spikes/m^2 in the combined (Table 5). Giza 168 variety achieved the greatest No. of spikes/m^2 followed by Gemmeiza 11 and Misr 1 varieties without significant differences between them, while Sids 12 recorded the lowest No. of spikes/m^2 in the combined. Therefore, wheat varieties differed in genes controlling No. of spikes/m^2.

Whereas, highly significant differences were detected between wheat varieties for No. of grains/spike during the two seasons and their combined. Giza 168 and Sids 12 varieties had greater No. of grains/spike without significant differences between them, whereas Misr 1 had the lower No. of grains/spike in the two seasons and their combined (Table 5).

As shown in Table 6, insignificant differences between wheat varieties were noticed in the 1st season, while, significant and highly significant differences were recorded between varieties in 2nd season and combined for 1000-grain weight. Sids 12 variety recorded the heaviest 1000-grain weight (gm) followed by Gemmeiza 11 variety without any significant differences between them and then Misr 1, while Giza 168 variety gave the lightest 1000- grain weight (gm) in 2nd season and combined. These results matching with **Duric *et al*. (2016) and Abd El-Rahman and El-Saidy (2016)** who found significant differences between genotypes for this trait.

For grain yield/fad., Table 6 results revealed that highly significant effects between wheat varieties were noticed in the 1st season. Hereby, wheat varieties varied in genes controlling grain yield. Gemmeiza 11 and Sids 12 gave the greatest grain yield/fad., with values of 2063.32 and 2034.89 kg/fad., respectively. It is interest to note that Sids 12 showed superiority in grain yield, and each of the two components *i.e.,* No. of grains/spike and 1000-grain weight. While Misr 1 and Giza 168 gave the lowest grain yield/ fad., valued 1899.49 and 1950.59, respectively. On the other hand, no significant effects between wheat varieties were recorded in the 2nd season and combined for this trait. Whereas, significant genetic variation was observed for wheat grain yield and its components by **Khan *et al.* (2007) and Duressa and Ayana (2020) and Awaad (2021). Al-Otayk (2019)** displayed significant variation for number of spikes/m^2, kernels spike^{-1}, 1000-kernel weight, grain yield and straw yield. The genotypes AC-3, AC-5 and BS-1 had higher grain yield and stable in performance across seasons. **Abd El-Rahman and El-Saidy (2016)** indicated that Giza 168 recorded the greatest No. of spikes/m^2 among the studied wheat genotypes. **Cvetkovic *et al.* (2016)** reported genetic differences between genotypes for No. of grains/spike, and the greatest number of grains per spike was obtained by cultivar Etida (54.8) and lowest in Zvezdana (51.4).

Effect of seed categories

As shown in Tables 5 and 6, the results showed significant or highly significant differences between seed categories through the two seasons and it's combined for No. of spikes /m^2, 1000-grain weight (gm) and grain yield Kg/fad. Whereas, insignificant and highly significant differences were detected between seed categories through 1st season and both of the 2nd season and combined in No. of grains/spike, respectively.

Generally, the greatest No. of spikes/m^2 and No. of grains/spike, 1000- grain weight (gm) and grain yield kg/fad were achieved by basic seed category then certified seed category, while the farmer seed category had the lowest values in grain yield and its components in two season and its combined. **Muhammed *et al*. (2012)** indicated that number of fertile tillers/ m^2 were significantly higher in certified seed source than the farmer's own seed that resulted in significant increase in grain yield. Other yield contributing parameters including numbers of grains/ spike and 1000- grain weight were at par in both seed sources. It was concluded that pure seed source gave the best yield attributes. Whereas, **Tyagi *et al.* (1985)** found that farmer's seeds gave the lowest yield consistently. **Duric *et al*. (2016)** indicated that seed category pre- basic seed had

Table 5. Mean performance of No. of spikes/m^2 and No. of grains/spike for some wheat varieties under three seed categories during two successive seasons (2014-2015 and 2015-2016) and their combined

Main effect and interaction	No. of spikes/m^2			No. of grains/spike		
	2014-2015	2015-2016	Combined	2014-2015	2015-2016	Combined
Varieties						
Misr 1	327.83	331.28	329.56 ab	48.27 c	43.73 b	46.00 b
Gemmeiza 11	365.00	338.51	351.75 a	52.58 b	44.13 b	48.35 b
Giza 168	345.50	374.78	360.14 a	54.10 ab	53.35 a	53.73 a
Sids 12	307.50	326.23	316.87 b	57.74 a	49.51 a	53.63 a
F- test	N. S	N. S	*	**	**	**
Seed categories						
Basic seed	362.00 a	371.67 a	366.83 a	54.24	52.42 a	53.33 a
Certified seed	327.63 b	344.66 b	336.14 b	54.12	47.87 b	50.99 b
Farmer seed	319.75 b	311.77 c	315.76 c	51.15	42.75 c	46.95 c
F – test	**	**	**	N.S	**	**
Interaction	*	N.S	N.S	NS	N.S	N.S

N.S, * and ** indicated insignificant and significant at 0.05 and 0.01 levels of probability, respectively.

Table 5-a. No. of spikes/m^2 as affected by the interaction between wheat varieties and seed categories (1st season)

Seed categories \ Varieties	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic seed	B	A	B	C
	358.00 a	434.50 a	342.50 a	313.00 a
Certified seed	AB	AB	AB	B
	331.00 ab	330.50 b	352.00 a	297.00 a
Farmer seed	B	AB	A	A
	294.50 b	330.00 b	342.00 a	312.50 a

Table 6. Mean performance of 1000- grain weight and grain yield (kg/fad) for some wheat varieties under three seed categories during two successive seasons (2014-2015 and 2015- 2016) and their combined

Main effect and interaction	1000- grain weight (g)			Grain yield (kg/fad)		
	2014-2015	2015-2016	Combined	2014-2015	2015-2016	Combined
Varieties						
Misr 1	48.17	46.94 bc	47.55 b	1899.49 b	2701.40	2300.45
Gemmeiza 11	50.48	51.15 ab	50.81 ab	2063.32 a	2700.28	2381.80
Giza 168	45.24	43.96 c	44.60 b	1950.59 b	2903.42	2427.01
Sids 12	50.98	54.73 a	52.85 a	2034.89 a	3317.50	2676.20
F- test	N. S	*	**	**	N.S	N. S
Seed categories						
Basic seed	51.64 a	52.33 a	51.99 a	2172.95 a	3232.40 a	2702.68 a
Certified seed	48.38 b	50.25 a	49.32 a	2064.13 b	2967.70 b	2515.92 b
Farmer seed	46.12 b	44.99 b	45.56 b	1724.12 c	2516.85 c	2120.49 c
F – test	**	*	**	**	**	**
Interaction	N.S	N.S	N.S	*	N.S	N.S

NS, * and ** indicated insignificant and significant at 0.05 and 0.01 levels of probability, respectively

Table 6-a. Grain yield kg/fad as affected by the interaction between wheat varieties and seed categories (1st season)

Varieties / Seed categories	Misr1	Gemmeiza 11	Giza 168	Sids 12
Basic seed	B	A	B	A
	2046.10 a	2286.26 a	2091.33 a	2268.11 a
Certified seed	B	AB	B	A
	1989.43 a	2083.68 b	1995.73 a	2187.69 a
Farmer seed	BC	A	AB	C
	1662.93 b	1820.01 c	1764.70 b	1648.87 b

the largest number of yield traits. **Akhter *et al.* (2015)** indicated that farmers who had access to certified wheat seed were able to achieve higher crop yields, higher income, and lower poverty as compared to farmers having no access to certified wheat seed. Also, **Tenge *et al.* (2016**) reported that use of uncertified seed by farmers contributed to high disease incidence.

Effect of interaction

As presented in Table 5-a, results indicated significant effects in the 1^{st} season and insignificant in the 2^{nd} one and combined between the two studied factors on No. of spikes/m^2, while it was insignificant during two seasons and it's combined on No. of grains/ spike, 1000- grain weight as well as significant interaction effects were noted regarding grain yield (kg/ fad) in the 1^{st} season, and insignificant interaction effects in the 2^{nd} one and the combined.

Respecting the 1^{st} season, results in Table 5-a revealed that the highest value of No. of spikes/m^2 (434.50) was achieved by Gemmeiza 11 with basic seed category, while the lowest value for No. of spikes/m^2 (294.50) was recorded by Misr 1 with farmer seed category.

Interaction effects between wheat varieties and their seed categories in the 1^{st} season for the grain yield (Table 6-a), revealed that higher grain yield (kg/fad.) was obtained by Gemmeiza 11 and Sids 12 varieties with basic seed category. While the lower grain yield (kg/fad.) was recorded by Misr1 and Sids 12 varieties with farmer seed category. In this manner, **Khan *et al.* (2007)** found that pre-basic category of Bakhtawar-92 obtained from CCRI, Pirsabak gave the maximum spikes m^2 (347.3), grains/ spike (52.30), 1000-grain weight (52.75 g), grain yield (4931 kg ha), followed by basic and certified categories of the same varieties and location. Grain yield and genetic purity based on number of off-types and seed fingerprint were significantly reduced from planting farmer-saved seeds compared with basic, registered and certified seeds. In continuous, **Adinew and Mohmmed (2019)** recorded significant interaction between seed source and wheat variety on grain yield/ha. Otherwise, **Duric *et al.* (2016)** indicated insignificant effects of the interaction between seed categories and varieties on 1000-grain weight, but significant interaction on No. of grains/spike.

Specific Characters

Off- type parentage

Off- type percentage as affected by wheat varieties and seed categories in addition the interaction between them during both seasons and their combined are presented in Table 7.

Effect of varieties

Data presented in Table 7 indicated insignificant effects between wheat varieties for off-type trait during the both seasons and the combined.

Effect of seed categories

Regarding the effect of seed categories on off- types percentage, the results in Table 7 indicated highly significant influenced of the off- types percentage by seed categories in both seasons. Farmer seed gave the maximum off-types percentage (3.62 and 3.25) in both seasons. On contrast, basic seed category provided the minimum off-types percentage (1.68 and 1.56) in both seasons. These results reflect the good yield measurements recorded by the basic seed category during this study. Meanwhile, **El-Kalla *et al*. (2010)** indicated that grain yield and genetic purity based on number of off-types and seed fingerprint were significantly reduced from planting farmer-saved seeds compared with basic, registered and certified seeds. So, it is possible to utilize farmer-saved seed for one year of certified seed provided that the farmer takes out the off-types from the part of his field he keeps for next planting. **Squires *et al*. (2014)** implied three primary sources for seeds of off-type colour *i.e.,* admixtures of genetically different varieties, true-to-type varieties and the last source of variation was attributed to unknown environmental interactions in genetically pure samples.

Effect of interaction

Insignificant interaction effects were found between wheat varieties and seed categories on off- types percentage as obvious in Table 7.

Phenol color reaction test

Results of phenol test in Table 8 showed that phenol color reaction was diverse between varieties under different times. Misr 1 and Gemmeiza 11 varieties took the light brown color after the 1^{st} hour and then the brown color

Table 7. Mean performance of off- type percentage for some wheat varieties under three seed categories during two successive seasons (2014-2015 and 2015-2016) and their combined

Main effect and interaction	Off- type percentage		
	2014-2015	2015-2016	Combined
Varieties			
Misr 1	2.58	2.25	2.41
Gemmeiza 11	2.08	2.08	2.08
Giza 168	2.33	2.08	2.20
Sids 12	2.75	2.25	2.29
F- test	NS	NS	NS
Seed categories			
Basic seed	1.68	1.56	1.62
Certified seed	2.00	1.86	1.84
Farmer seed	3.62	3.25	3.28
F - test	**	**	**
Interaction	N.S	N.S	N.S

NS, * and ** indicated insignificant and significant at 0.05 and 0.01 levels of probability, respectively

Table 8. Effect of phenol reaction of wheat varieties and their seed categories using 1% concentration under one, two, three and 4 hours

Time	1 hour			2 hours			3 hours			4 hours		
Varsities	Basic seed	Certified seed	Farmer seed	Basic seed	Certified	Farmer seed	Basic seed	Certified seed	Farmer seed	Basic seed	Certified seed	Farmer seed
Giza 168	++	++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Misr 1	+	+	+	++	++	++	+++	+++	+++	++++	++++	++++
Gemmeiza 11	+	+	+	++	++	++	+++	+++	+++	++++	++++	++++
Sids 12	-	-	-	-	-	-	-	-	-	+	+	+

- indicate absence color + indicate light brown ++ indicate brown +++ indicate dark brown ++++ indicate very dark brown after the 2nd hour and then dark and very dark brown after the 3rd and 4th hours, respectively. While, Giza 168 variety took the brown color after the 1st hour and then the very dark brown color after the 2nd hour till the end of the test. On the other hand, Sids 12 didn't have any color with the phenol till the third hour and took the light brown color after the 4th hour. Seed categories took the same pattern in phenol color reaction for each variety. In this regard, wheat varieties showed different color reactions to phenol by **Eman (2011), Niranjana *et al.* (2018) and Pavlic *et al*. (2018)**

ISSR marker technology

ISSR markers were able to distinguish morphologically distinct and similar accessions and provide steady information on the genetic variability among wheat varieties that will help in breeding programs. In the current study eight primers of ISSR were selected to distinguish among wheat varsities. These primers produced multiple bands, which ranged between 2 polymorphic bands for primer HB-09 with 28.57% polymorphism to 19 bands for primer HB- 12 which showed 95.00% polymorphism. The total number of bands was 97 of them 66 were polymorphic with 68.04% polymorphism as shown in Table 9 and Fig. 1. Primer 14A produced 11 bands with the fragment sizes ranging from 250 bp to 1290 bp, 8 of them were polymorphic (72.72% polymorphism). Primer 44B produced 14 bands with the fragment sizes ranging from 290 bp to 2270 bp, 8 of them were polymorphic (57.14% polymorphism). HB-8 formed 9 bands with the fragment sizes ranging from 270 bp to 1240 bp, 5 of them were polymorphic (55.55% polymorphism). Primer HB-10 generated 16 bands with the fragment sizes varied from 200 bp to 960 bp, 12 of them were polymorphic (75.00% polymorphism). Whereas, primer HB-12 produced 20 bands with the fragment sizes ranging from 220 bp to 1110 bp, 19 of them were polymorphic which giving 95% polymorphism. Primer HB-13 produced 8 bands with the fragment sizes ranging from 305 bp to 740 bp, 5 of them were polymorphic (62.50% polymorphism). Primer HB-15 showed 12 bands with the fragment sizes ranging from 195 bp to 1590 b, 7 of them were polymorphic (58.33% polymorphism). ISSRs have been successfully used to assess the genetic diversity of wheat varieties. The genetic relationships estimated by the polymorphism of ISSR markers revealed greater level of genetic variability in wheat accessions of wide adaptability and applicability **(Singh and Jaiswal, 2016; Heidari *et al*., 2017; Mandoulakani *et al*., 2017; Nazarzadeh *et al.*, 2020)**.

Cluster Analysis

The dendrogram resulting from the UPGMA cluster analysis showed that the studied varieties could be divided into two main clusters (Fig. 2). The first cluster contained two sub-clusters. The first sub-cluster contained two varieties (Mr1Cer S. and Mr 1 Bas S.), the second sub cluster contained two varieties (Gm 11 Cer. S. and Mr 1 Far S. The second cluster was divided into two sub-clusters, the first sub-cluster included one variety (Gm 11 Far S.), the second sub cluster contained 8 varieties (Sd 12 Far S., Sd 12 Cer S., Gz 168 Cer S., Sd 12 Bas S., Gz 168 Far S, Gz 168 Bas S., Gm 11 Bas S. and Gm 11 Far S.). In this concern, molecular markers have been exploited in wheat breeding programs and detected higher percentage of polymorphisms among wheat varieties**.** Genetic diversity of wheat varieties has been detected based on ISSR molecular markers by **Mandoulakani *et al*. (2017) and Varsha *et al.* (2018)**.

Genetic Diversity

The similarity matrix revealed high percentage of similarity between the varieties. Results in Table 10 showed the genetic diversity coefficients among wheat varieties. The highest similarity was observed between the varieties Gz 168 Far S. and Sd 12 Bas S. with similarity coefficient value of 0.89, while the lowest similarity value was obtained by the varieties Mr 1 Cer S. and Gm 11 Far S. with similarity coefficient value of 0.66. Appearance of differential differences between the studied materials might be due to the effect of the genotypic effect and their interaction with different seed categories on the DNA. Similar results were reported by **Singh and Jaiswal (2016), Heidari *et al*. (2017) and Varsha *et al.* (2018)**.

Table 9. Number of monomorphic, polymorphic bands and polymorphism percentage produced by each ISSR primer of the tested wheat varieties

Primers	Size of bands (bp)	Total no. of bands	Monomorphic bands	Polymorphic bands	Polymorphism %
14 A	250:1290	11	3	8	72.72
44 B	290:2270	14	6	8	57.14
HB- 10	450- 1250	16	4	12	75.00
HB- 12	220-1110	20	1	19	95.00
HB-13	305-740	8	3	5	62.50
HB -15	195-1590	12	5	7	58.33
HB-08	270-1240	9	4	5	55.55
HB-09	450-1250	7	5	2	28.57
Total		97	31	66	68.04

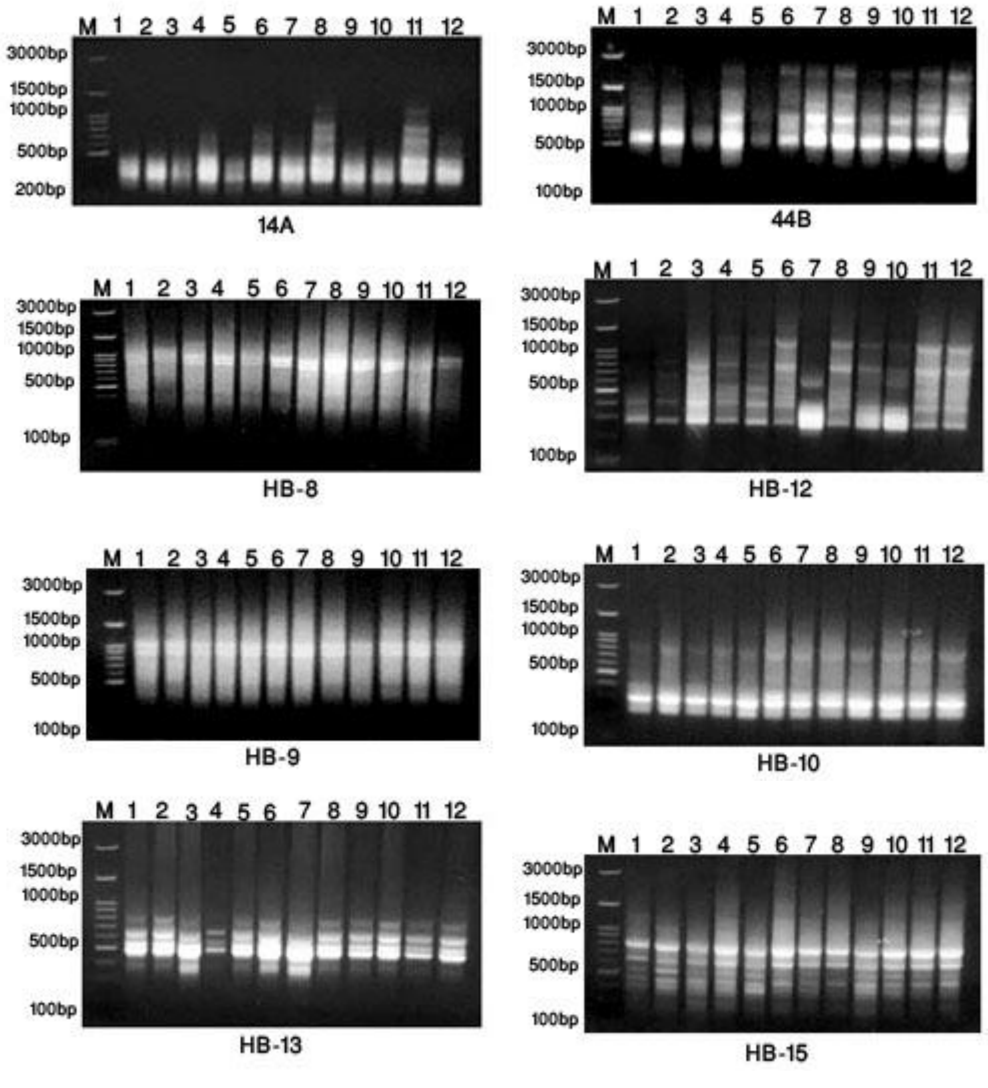

Fig. 1. ISSR pattern obtained by 8 primers of the tested wheat varieties

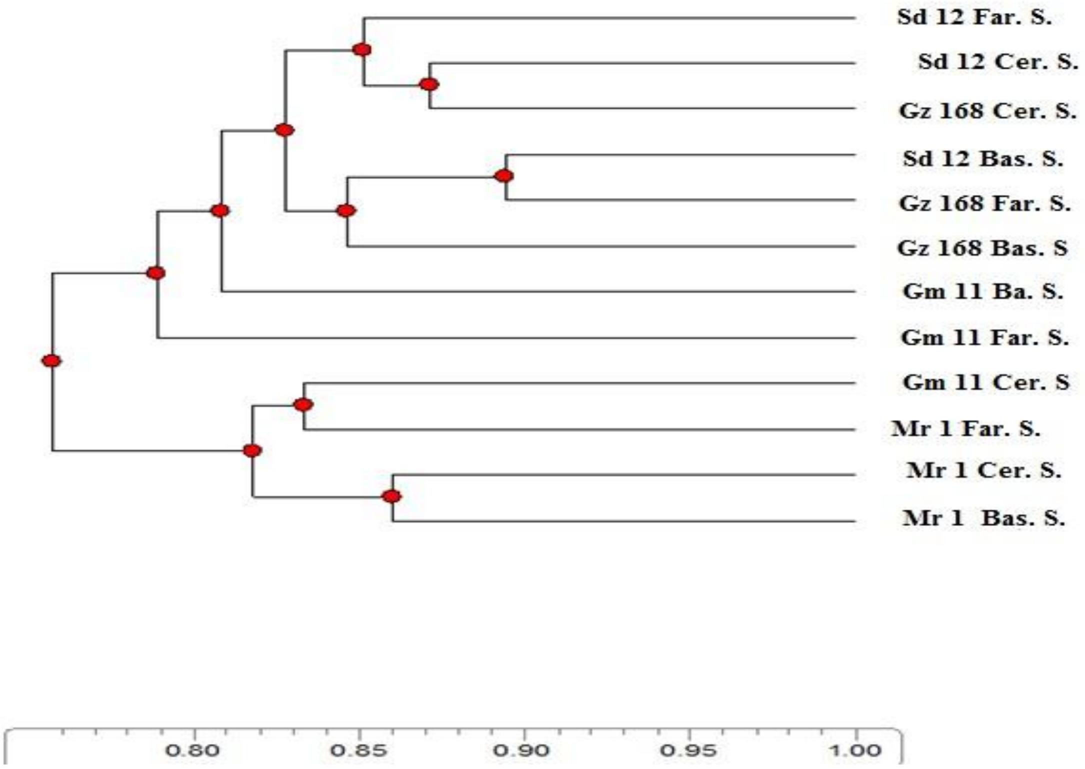

Fig. 2. A dendrogram based UPGMA cluster analysis of ISSR showing the relationships between the different wheat varieties

Table 10. Genetic diversity coefficients among wheat varieties and seed categories

Lane	Mr 1 Bas. S.	Mr 1 Cer. S.	Mr 1 Far. S.	Gm 11 Ba. S.	Gm 11 Cer. S.	Gm 11 Far. S.	Gz 168 Bas. S	Gz 168 Cer. S.	Gz 168 Far. S.	Sd 12 Bas. S.	Sd 12 Cer. S.	Sd 12 Far. S.
Mr 1 Bas. S.	1											
Mr 1 Cer. S.	0.86	1										
Mr 1 Far. S.	0.85	0.79	1									
Gm 11 Ba. S.	0.8	0.75	0.8	1								
Gm 11 Cer. S.	0.81	0.82	0.83	0.79	1							
Gm 11 Far. S.	0.73	0.66	0.82	0.8	0.78	1						
Gz 168 Bas. S	0.75	0.7	0.75	0.83	0.78	0.81	1					
Gz 168 Cer. S.	0.74	0.69	0.7	0.81	0.75	0.82	0.86	1				
Gz 168 Far. S.	0.79	0.73	0.79	0.77	0.82	0.76	0.83	0.82	1			
Sd 12 Bas. S.	0.79	0.73	0.77	0.81	0.82	0.79	0.87	0.86	0.89	1		
Sd 12 Cer. S.	0.74	0.67	0.76	0.81	0.75	0.78	0.78	0.87	0.8	0.86	1	
Sd 12 Far. S.	0.75	0.78	0.75	0.82	0.76	0.75	0.81	0.86	0.8	0.87	0.84	1

Mr1 (Misr 1), Gm11 (Gemmeiza 11), Gz168 (Giza 168), Sd 12 (Sids 12), Bas.S. (Basic seed), Cer.S. (Certified seed) and Far. S. (farmer seed)

REFERENCES

Abaza, G.M., H.A. Awaad, Z.M. Attia, K.S. Abdel-Lateif, M.A. Gomaa, S.M. Abaza and E. Mansour (2020). Inducing potential mutants in bread wheat using diferent doses of certain physical and chemical mutagens. Plant Breed Biotechnol., 8:252–264.

Abd El-Rahman, M. E. and A.E.A. El-Saidy (2016). Response of yield and grain of quality of some bread weight (*Triticum aestivum* L.) genotypes to different sowing dates. J. Plant Prod., Mansoura Univ., 7 (10): 1043-1051.

Adinew, A. and W. Mohamed (2019). Effect of seed sources and rates on productivity of bread wheat (*Triticum aestivum* L.) varieties at Kersa, Eastern Ethiopia. J. Biol., Agric. and Healthcare, 9(3): 1-9.

Akhter, A., D. Rahut, B. Behera and M. Imtiaz (2015). Farmers' access to certified wheat seed and its effect on poverty reduction in Pakistan. J. Crop Improv., 29 (2): 247-265.

Alemu, G. (2019). Review on the effect of seed source and size on grain yield of bread wheat (*Tritium aestivum* L.). J. Ecol. and Nat. Res., 3 (1): 1-9.

Al-Otayk, S.M. (2019). Evaluation of agronomic traits and assessment of genetic variability in some popular wheat genotypes cultivated in Saudi Arabia. Aust. J. Crop Sci., 13 (6): 847-856.

Amal, H.S. (2004). Some factors affecting the value of phenol test used in wheat identification. Egypt. J. Agric. Res., 82 (4): 1657-1664.

Arif, U., S.N.M. Shah, Z. Shaofeng, M. Khan and S. Ali (2015). Impact of education and certified seeds on wheat production in Kohat, Pakistan. Asian J. Agri. Ext., Econ. and Sociol., 4 (1) :42-48.

Attia, A.N.E, M.S.A. Sultan, M.A. Badawi and A.A.K. Alfahdawey (2015). Morphological identification of some wheat varieties and its crosses. J. Plant Prod., Mansoura Univ., 6 (6): 889 – 901

Awaad, H. A. (2021). Performance, adaptability and stability of promising bread wheat lines across different environments. *In*: Awaad HA, M Abu-hashim and A Negm, Handbook of Mitigating Environ. Stresses for Agric. Sustainability in Egypt, Springer Nature Switzerland AG, 178-213.

Awaad, H.A., M.A.H. Yousef and E.S.A. Moustafa (2010). Identification of genetic variation among bread wheat genotypes for lead tolerance using morpho—physiological and molecular markers. J. Ame. Sci., 6 (10): 1142–1153.

Banerjee, S.K. and S. Chandra (1974). Modified phenol test for the varietal identification of wheat seed. Reprint No. 8- SVI 17th ISTA Congress, Warsaw.

Bishaw, Z., P.C. Struik and A.J.G. van Gastel (2012). Farmers' seed sources and seed quality on physical and physiological quality. J. Crop Improv., 26 (5): 655-692.

Cvetkovic, D., D. Boshev, Z. Dimov, S. Ivanovska and M. Jankulovska (2016). Yield and yield components on some wheat varieties grown in Aleksinac region. J. Agric., Food and Environ. Sci., 69 (4): 98-105.

Duressa, L.A. and N.G. Ayana (2020). Effects of variety and fertilizer rate on yield of bread wheat (*Triticum aestivum*, L) varieties in East Wollega Zone, Western Ethiopia. Agric. and Biolo. Sci. J. 6 (2): 60-71.

Duric, N., M. Matkovic, G. Cvijanovic and G. Dozet (2016). Analysis of main additive effects and multiplicative interactions of components of yield of certain wheat genotypes. Ratarstvo i Povrtarstvo., 53 (2): 61-68.

El-Kalla, S.E., A.A. Lillah, M.I. El-Emery and A. Kishk (2010). Determination of genetic purity in three common wheat (*Triticum aestivum* L.) varieties. Res. J. Seed Sci. 3 (4): 227-233.

Eman, M.A.I. (2011). Laboratory methods for the recognition of seeds of some wheat (*Triticum aestivum* L.). J. Plant Prod., Mansoura Univ., 2 (1): 157-163.

FAO.STAT, F. (2020/21). Food and agricultural, organization of the united nation resources, Rome, Italy: http://www.fao.org/ faostat/ en/data.

Gaines, T., C. Preston, P. Byrne, W.B. Henry and P. Westra (2007). Adventitious presence of herbicide resistant wheat in certified and farm-saved seed lots. Crop Sci., 47 (2): 751-756.

Heidari, S., R. Azizinezhad and R. Haghparast (2017). Investigation on genetic diversity in (*Triticum turgidum* L.) var. durum using agro-morphological characters and molecular markers. Indian J. Genet. and Plant Breed., 77 (2): 242-250.

Khan, A.Z., H. Khan, R. Khan, A. Ghoneim and A. Ebid (2007). Comparison of different wheat seed categories (vs) farmer's seed: yield and yield components. Trends in App. Sci. Res., 2 (6): 529-534.

Khazaei, F., M. Aghaalikhani, S. Mobasser, A. Mokhtassi-Bidgoli, H. Asharin and H. Sadeghi (2016). Evaluation of wheat (*Triticum aestivum*, L.) seed quality of certified seed and farm-saved seed in three provinces of Iran. Plant Breed. and Seed Sci., 73 (1): 99-115.

Mandoulakani, B., A. Nasri, S. Dashchi, S. Arzhang, S. Bernousi and H. A. I. Holasou (2017). Preliminary evidence for associations between molecular markers and quantitative traits in a set of bread wheat (*Triticum aestivum* L.) cultivars and breeding lines. Comptes Rendus Biologies, 340 (6/7): 307-313.

Muhammad, T., R.M. Omer, M.A. Mian, R. Obaid-ur, A.T. Virk and A. Kazim (2012). Promoting certified seed availability of wheat (*Triticum aestivum* L.) through public-private partnership and its impact on yield in rainfed areas. Pak. J. Agri. Res., 25 (3): 174-180.

Nazarzadeh, Z., H. Onsori and S. Akrami (2020). Genetic diversity of bread wheat (*Triticum aestivum* L.) genotypes using RAPD and ISSR molecular markers. J. Genet. Res., 6 (1): 69-76.

Niranjana, M., K.J. Shailendra, M. Niharika, A. Verma, S. Bhanwar, A. Ahlawat and S.M.S. Tomar (2018). Distribution of genes producing phenol colour reaction in grains of wheat and its related species, mode of inheritance and breeding for low polyphenol activity. Indian J. Genet., 78(4): 433-442.

Pavlic, L., S. Petrovic, I. Rukavina, S. Vila, S. Guberac, V. Orkic and V. Guberac (2018). Application of phenol test for seed purity examination in wheat gene collection. 53. hrvatski i 13. meunarodni simpozij agronoma, 18. Do 23. velijace 2018., Vodice Hrvatska. Zbornik radova, 206-210.

Shahwani, A.R., S.U. Baloch, S.K. Baloch, B. Mengal, W. Bashir, H.N. Baloch, R.A. Baloch, A.H. Sial, S.A.I. Sabiel, K. Razzaq, A.A. Shahwani and A. Mengal (2014). Influence of seed size on germ inability and grain yield of wheat (*Triticum aestivum* L.) varieties. J. Nat. Sci. Res., 4 (23): 147-155.

Singh, P. and J.P. Jaiswal (2016). Assessing genetic diversity in bread wheat using inter simple sequence repeat (ISSR) markers. Asian J. Bio. Sci., 11(1): 141-145.

Squires, C.C., D.R. See and A.H. Carter (2014). Sources of seed coat colour variation in certification-candidate wheat seed. Seed Sci. and Tech., 42(2): 247-259.

Steel, R.G.D. and J. H. Tonle (1997). Principles and Procedures of Statistics. McGraw-Hill Inc., New York, USA

Tenge, B.N., P.P.O. Ojwang, D. Otaye and M. E. Oyoo (2016). Wheat stem rust disease incidence and severity associated with farming practices in the Central Rift Valley of Kenya. Afr. J. Agri. Res., 11 29): 2640-2649.

Tyagi, C.S., M.S. Paroda, M.S. Panwar and C. Ram (1985). Comparative performance of different classes of seeds for quality parameters in laboratory and field in wheat, Seeds and Farms, 11 (11): 51-57.

UPOV (1994). The International union for the protection of new varieties of plants. Guidelines for the conduct of tests for distinctness, uniformity and stability for wheat. no.TG/3/11, 36.

Varsha, Y., K. Pardeep and G. Meenu (2018). Evaluation of genetic diversity in drought tolerant and sensitive varieties of wheat using ISSR markers, Electronic. J. Plant Breed., 9 (1): 146-153.

Williams, J.G.K., A.R. Kubelk, K.J. Livak, J.A. Rafalski and S.V. Tingey (1990). DNA polymorphisms amplified by arbitrary primers are useful as genetic markers. Nucl. Acid Res., 18 (22): 6531-6535.

Yang, X. and C. Quiros (1993). Identification and classification of celery cultivates with RAPD markers. Theor. Appl. Genet., 86: 205–212.

التحقــق مــن النقـــاوة الـــوراثيــــة وتأثـــرهــا بمصـــادر البذرة لأربعة أصناف من قمح الخبــز

محمد السيد سعيد قمورة [1]- أحمد عبدالغني علي[2]- حسن عودة عواد[2]- محمود إبراهيم العميرى[1]

1- قسم تكنولوجيا البذور- معهد المحاصيل الحقلية- مركز البحوث الزراعية - مصر

2- قسم المحاصيل- كلية الزراعة- جامعة الزقازيق - مصر

تلعب درجات التقاوى وأصناف المحصول دوراً هاماً فى إنتاج القمح فى مصر والتأثير على النقاوة الوراثية للتراكيب الوراثية في القمح. لذلك يهدف هذا البحث الي دراسة تأثير مصادر التقاوى والاصناف والتفاعل بينهما على المحصول ومكوناته. أجريت تجربتان حقليتان بمحطة البحوث الزراعية - مركز البحوث الزراعية - الجيزة – جمهورية مصر العربية خلال الموسم الشتوي لاعوام 2014- 2015 و 2015- 2016 فى الميعاد الأمثل للزراعه 15 نوفمبر. واستخدمت فى هذه الدراسة أربعة أصناف من القمح " مصر1، جميزه 11، جيزة 168 وسدس 12" مع ثلاث درجات تقاوى لكل صنف " بذور الأساس- البذور المعتمدة وبذور المزارع". تم تقدير المحصول ومكوناته ونسبة الشوارد فى التجربة الحقلية، بالإضافة إلى إجراء إختبار الفينول وإختبار ISSR بمعمل قسم بحوث تكنولوجيا البذور. أوضحت النتائج وجود إختلافات معنوية بين التراكيب الوراثية للقمح ودرجات التقاوى لمعظم الصفات. أعطى الصنف جميزة 11 أعلى القيم فى معظم الصفات المدروسة " محتوى ورقة العلم من الكلوروفيل، مساحة ورقة العلم، طول السنبلة، عدد السنابل/م^2، عدد حبوب السنبلة، وزن الألف حبه ومحصول الحبوب/فدان"، بينما سجل الصنف مصر1 أقل القيم لتلك الصفات. بالنسبة لتاثير درجات التقاوى على المحصول ومكوناته، أعطت بذور الأساس أعلى القيم فى معظم الصفات، ماعدا إرتفاع النبات حيث سجلت بذور المزارع أعلى قيمة لهذه الصفة. لوحظت تأثيرات غير معنوية لدرجات التقاوى على محتوى ورقة العلم من الكلوروفيل. أوضحت نتائج تأثير التفاعل بين التراكيب الوراثية ودرجات التقاوى أن تفاعل الصنفان جميزة 11 وسدس 12 مع كل من درجتى الأساس والمعتمدة أعطى أعلى القيم لمعظم الصفات، بينما أعطى التفاعل بين الصنف مصر1 وبذور المزارع أقل القيم لتلك الصفات. كانت هناك تأثيرات غير معنوية للتراكيب الوراثية على نسبة الشوارد، بينما كان لدرجات التقاوى تأثيرات عالية المعنوية، حيث سجلت بذور المزارع أعلى القيم. وأظهرت أصناف القمح إختلافات لونيه لإختبار الفينول، بينما أخذت درجات التقاوى نفس التفاعل لكل صنف. وفيما يتعلق بتحليل ISSR –PCR أستخدمت ثمانية بادئات للتمييز بين أصناف القمح الأربعة ودرجات تقاويها. وأظهرت النتائج وجود 97 علامة جزيئية منهم 31 علامة جزيئية مختلفة بنسبة 68.04% . وأظهر البادئ HB-12 أعلى نسبة إختلاف بين الأصناف موضع الدراسة بنسبة 95%، بينما أظهر البادئ HB-09 أقل نسبة إختلاف % 28.57.

المحكمـــون :

1 - أ.د. عفــــاف طلبـــــه أستاذ المحاصيل – كلية الزراعة – جامعة عين شمس.

2- د. محمد عبد السلام طه أستاذ المحاصيل المساعد – كلية الزراعة – جامعة الزقازيق.