J. Plant Production, Mansoura Univ., Vol. 8 (12): 1351 - 1354 , 2017

The Role of Seed Classes in Improving Purification and Productivity of Rice

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ABSTRACT

The field experimentes were conducted during 2016 and 2017 rice growing seasons. The investigation aimed to study the effect of seed classes i.e. breeder, foundation, registered and farmer and the studied cultivars i.e. Sakha 101, Giza 177, and Giza 178 on the productivity of rice *(Oriza sativa)*. Split plot design with three replications was used, the main plots were randomely occupied by four classes of seeds, while the cultivars Sakha 101, Giza 177, and Giza 178 were assigned to the sub plots. Results showed that, breeder seeds gave the highest grain yield (10.97 and 11.34 t ha-1) in 2016 and 2017 seasons, respectively. The highest grain yield (10.51 and 10.83 t/ha) was obtained from variety Sakha 101 in both seasons, respectively. The interaction between cultivars and seed classes was highly significant for germination (%), shoot length (cm), root length (cm), days to heading, number of tillers/hill, panicle weight (g), panicle length (cm), seed set (%), 1000-grain weight and grain yield, while not significant was found for plant height (cm) during 2016 and 2017 seasons. The results indicated that both of rice varieties and seed classes were important for increasing grain yield.

Keywords: Rice, cultivars, seed classes, grain yield and seedling characters.

INTRODUCTION

Rice is the staple food for a large part of Asia, Africa, some parts of Europe, and West Indies (FAO, 2012). Demands of rice are progressively increasing so, great efforts should be under taken to satisfy the requirements of world population to this vital crop. This production increment must be sustainable. Good quality rice seed is able to regenerate a high percentage of viable seed or rather productive (Asaki *et al.*, 2013).

Rice is one of the most important grain crops in Egypt providing a good source of income. It is a main stable food for the majority of the population and has become a cash export crop. So, increasing its products is a national target in Egypt.

Studies on farmer seed management practices revealed that, in most cases, the growers do not purchase certified seeds, most of them grow their own seeds or exchange seeds of available varieties with other farmers (Diaz *et al.*, 1994). Seeds obtained from the second cropping were considered to have better quality and were used for planting in the next season (Escalada *et al.* 1996).

High quality of seed is the primary source to proper nursery and quick seedling establishment in the open field (Zubairu *et al.*, 2014). Using good quality of seed is important to maintain the yield and quality. One of the important determinants of seed quality is varietal purity significant influences the crop yields affecting the production practices (Seshu and dadlani 1989).

Since rice productivity is highly influenced by rice cultivars, and seed classes, it has become very important to grow highly purified seed of high yielding rice cultivars.

The investigation was carried out during 2016 and 2017 rice seasons at the experimental farm of Sakha Agricultural Research Station to study the effect of interaction between rice cultivars and seed classes on yield and its attributes.

MATERIALS AND METHODS

The field experiments were conducted at the Rice Research and Training Center during 2016 and 2017 rice growing. Split-plot design with three replications was used. Seed classes were in the main plot while, rice cultivars Sakha 101, Giza 177, and Giza 178, were in the sub plots. Rice seeds at rate of 60 kg/fed. were soaked in fresh water for 24 hours and then incubated for 48 hours to hasten germination. On may first in 2016 and 2017, respectively. 30 days old seedlings were transplanted in hills spaced 20 x 20 cm to gave 25 hills m-2 for traditional planting. cultural practices were similar to those used in the area. Rice plants were harvested at 140 days from sowing for Sakha 101, 135 days for Giza 178 and 125 days for Giza 177 (Anonymous 2016). Data were recorded from 10 randomly selected hills excluding border rows per sub plot. Data were collected for the following growth characters; germination %, shoot length (cm), root length, days to heading, plant height (cm), number of tillers/hill, panicle weight (g), panicle length (cm), seed set (%), 1000-grain weight (g) and grain yield (t/ha). The crop was harvested when 85% of the grains became golden yellow in color. Grains were sun-dried and adjusted at 14% moisture content to estimate grain yield. Seed germination and seed germination percentage was estimated as the following formulae:

$$\text{Seed germination \%} = \frac{\text{Number of germinated seeds}}{\text{Total number of tested seeds}} \times 100$$

Seed set percentage was calculated according to the following formula:

$$\text{Seed set \%} = \frac{\text{Number of filled grains}}{\text{Total number of spikelets}} \times 100$$

The data were collected according to Standard Evaluation System of IRRI 2014 for all the studied characters. The data were analyzed using ANOVA technique and the mean differences were compared by the Duncan's Multiple Range Test (Gomez and Gomez, 1984) using a statistical computer package MSTAT.

RESULTS AND DISCUSSION

The effect of seed classes on rice cultivars was shown in table (1). The results showed that, the mean values of Giza 177 were the highest for germination % (95.81 and 96.15 %) and shoot length (11.77 and 12.10 cm) in all studied seed classes. However, Sakha 101 came the second and Giza 178 was the last, for these traits. The longest root length was detected from Sakha 101 (12.01 and 12.56 cm) in the first and second seasons, respectively. The differences among the tested cultivars were highly significant. Giza 178 had short radical area comparing with other cultivars.

For seed classes, the highest values of germination percentage, shoot and root length were detected from breeder seed, followed by foundation seed, while the lowest values were recorded from farmer seed. Seed classes and interaction between cultivars and seed classes differed with highly significant values. These results are in agreement with those reported by Cerovich *et al.* (2004).

Table 1. Means of germination %, shoot length (cm) and root length (cm) as affected by rice cultivars, seed classes and their interaction

Main effect and interaction	Germination (%)		Shoot length (cm)		Root length (cm)	
	2016	2017	2016	2017	2016	2017
Cultivar (A)						
Sakha 101	95.68b	95.90b	11.55b	11.91b	12.01a	12.56a
Giza 177	95.81a	96.15a	11.77a	12.10a	10.48b	10.87b
Giza 178	94.70c	95.09c	9.16 c	9.49c	9.97c	10.05c
F- Test	**	**	**	**	**	**
Class (B)						
Breeder	97.98a	98.41a	11.69a	12.08a	11.34a	12.02a
Foundation	96.94b	97.24b	11.13b	11.58b	10.90b	11.50b
Registered	94.61c	94.81c	10.58c	10.81c	10.48c	10.89c
Farmer	92.10d	92.00d	9.91 d	10.23d	9.94d	10.23d
F – Test	**	**	**	**	**	**
Interaction (Ax B)	**	**	**	**	**	**

** Significant at level 1 % of probability. In a season, the values having the same letter(s) aren't significantly differ according to Duncan's multiple range test

The results in Table (2) showed that, the interactions between rice cultivars and seed classes were highly significant for germination percentage, shoot and root length. The highest germination % recorded from breeder seed for Giza 177 (98.41 and 98.81 %), followed by breeder seed for Sakha 101 and Giza 178, while the lowest values of germination % were found from farmer seed in all cultivars. Giza 177 (12.86 and 13.22 cm) and Giza 178 (12.43 and 12.81 cm) produced the longest shoots from breeder seed. The shortest shoot was detected from Sakha 101 with all seed classes. In contrast, the root length of Sakha 101 was the highest with all seed classes as compared with the two other cultivars. Similar results were stated by Cerovich *et al*. (2004).

Table 2. Means of germination %, shoot length (cm) and root length (cm) as affected by the interaction between rice cultivars and seed classes

Cultivar (A)	Classes (B)	Germination%		Shoot length (cm)		Root length (cm)	
		2016	2017	2016	2017	2016	2017
Sakha 101	Breeder	98.30	98.57	9.81	10.22	12.79	13.54
	Foundation	97.40	97.81	9.31	9.71	12.42	13.22
	Registered	94.92	95.02	9.02	9.32	11.90	12.32
	Farmer	92.01	92.21	8.51	8.72	10.86	11.17
Giza 177	Breeder	98.41	98.81	12.86	13.22	11.21	11.71
	Foundation	97.03	97.41	12.11	12.52	10.76	11.09
	Registered	95.01	95.31	11.51	11.62	10.12	10.54
	Farmer	92.91	93.08	10.64	11.08	9.86	10.16
Giza 178	Breeder	97.26	97.85	12.43	12.81	10.02	10.82
	Foundation	96.27	96.51	11.97	12.41	9.52	10.19
	Registered	93.90	94.11	11.22	11.51	9.34	9.84
	Farmer	91.39	91.89	10.59	10.92	9.03	9.39
LSD 0.05		3.63	0.11	3.74	0.05	2.53	0.07
LSD 0.01		5.45	0.16	5.62	0.08	3.80	0.10

The effect of seed classes on rice cultivars was shown in table (3). The data show that, Sakha 101 rice cultivar had the highest values for days to heading (110.71 and 112.03), number of tillers per hill (19.63 and 20.18) and panicle weight (3.86 and 4.02 g) in 2016 and 2017 seasons, respectively. The earliest cultivar was Giza 177 (93.62 and 95.18 days), but it produced the lowest number of tillers per hill. Differences in performance of the tested cultivars proved to be highly significant.

Table 3. Means of days to heading, plant height, number of tillers/hill and Panicle weight as affected by rice cultivars, seed classes and their interaction.

Main effect and interaction	Days to heading (day)		Plant height (cm)		Number of tillers/hill		Panicle weight (g)	
	2016	2017	2016	2017	2016	2017	2016	2017
Cultivar (A)								
Sakha 101	110.71a	112.03a	96.12c	96.26c	19.63a	20.18a	3.86a	4.02a
Giza 177	93.62 c	95.18c	101.56b	101.72b	15.17c	15.75c	3.77b	3.89b
Giza 178	102.97b	106.08b	102.59a	102.55a	19.32b	19.50b	3.64c	3.58c
F- Test	**	**	**	**	**	**	**	**
Class (B	100.04d	100.83d	100.36a	100.34ab	21.30a	21.85a	4.06a	4.34a
Breeder	101.98c	103.44c	100.32a	100.45a	19.67b	20.22b	3.92b	3.90b
Foundation	103.66b	105.45b	99.85a	100.04ab	16.83c	17.45c	3.76c	3.81c
Registered Farmer	104.16a	108.01a	99.85a	99.87b	14.36d	14.40d	3.29d	3.70d
F – Test	**	**	NS	NS	**	**	**	**
Interaction (A x B)	**	**	NS	NS	**	**	**	**

** Highly significant at the 1% level of probability and NS not significant. In a season, the values having the same letter(s) aren't significantly differ according to Duncan's multiple range test

Seed classes affected significantly on traits of days to heading, number of tillers per hill and panicle weight, but insignificantly on plant height (Table 3). The breeder seed produced the shortest period of days to heading (100.04 and 100.83), highest tillering (21.30 and 21.85) and heaviest panicles (4.06 and 4.34 g) in 2016 and 2017 seasons, respectively. In contrast, the farmer seed exhibited the longest duration to heading (104.16 and 108.01 days), least tillering (14.36 and 14.40 tillers) and produced the lightest panicles (3.29 and 3.70 g) in the first and second seasons, respectively.

The interactions between rice cultivars and seed classes were highly significant for days to heading, number of tillers/hill and panicle weight, but was insignificant in case of plant height. These results are in agreement with those reported by Badawi (2005), Gomaa (2010), Sedeek (2001) and Draz *et al* (2003).

The results in Table (4) showed that, the interactions between rice cultivars and seed classes were highly significant for days to heading, number of tillers/hill and panicle weight in 2016 and 2017 seasons. The breeder seed of Giza 177 exhibited the shortest duration of days to heading, followed by foundation seed of the same cultivar. Both breeder and foundation seed of Sakha 101 and Giza 177 produced the highest number of tillers per hill, while the lowest tillers were induced by farmer seed of all evaluated cultivars. The heaviest panicles were those of Sakha 101 and Giza 177 breeder and foundation seed. Bassal and Zahran (2002) and Ahmad *et al.* (2008) reported similar results.

Table 4. Means of days to heading, number of tillers/hill and Panicle weight as affected by the interaction between rice cultivars and seed classes

Cultivar (A)	Class (B)	Days to heading (day) 2016	Days to heading (day) 2017	Number of tillers/hill 2016	Number of tillers/hill 2017	Panicle weight (g) 2016	Panicle weight (g) 2017
Sakha 101	Breeder	107.83	107.83	23.52	23.83	4.25	4.58
	Foundation	109.77	110.96	21.27	22.17	4.05	4.17
	Registered	112.10	113.56	18.03	18.75	3.93	3.95
	Farmer	113.17	115.80	15.23	16.01	3.24	3.41
Giza 177	Breeder	90.69	91.72	17.62	17.96	4.02	4.41
	Foundation	93.52	94.82	16.02	16.76	3.95	3.92
	Registered	95.13	95.74	14.21	15.13	3.72	3.73
	Farmer	95.17	98.47	12.82	13.17	3.42	3.52
Giza 178	Breeder	101.60	91.72	22.77	23.77	3.93	4.06
	Foundation	102.37	94.82	21.71	21.74	3.77	3.63
	Registered	103.77	95.74	18.27	18.47	3.63	3.44
	Farmer	104.17	98.47	15.04	14.04	3.20	3.22
LSD 0.05		0.42	0.09	0.06	0.07	0.07	3.07
LSD 0.01		0.63	0.14	0.09	0.11	0.10	4.61

The performance of rice cultivars as influenced by seed class and their interaction of rice yield and some yield attributes are presented in table (5). Sakha 101 gave the greatest values of panicle length (22.43 and 22.99 cm), seed set (95.01 and 96.63 %) and grain yield (10.51 and 10.83 t/ha) in the first and second seasons, respectively, while Giza 178 and Giza 177 came in the second and third rank, respectively. For 1000-grain weight, Sakha 101 gave the heaviest grain (27.40 and 27.49 g), but Giza 177 came second (26.25 and 26.36 g) in 2016 and 2017 seasons, respectively. These results indicated that the increasing of genetic purity will increase number of filled grains/panicle. These results are in agreement with those reported by Badawi (2005), Abo Khalifa and El-Rewiny. (2005) and Ebaid (2005).

The results in Table (6) showed that, the interactions between rice cultivars and seed classes were highly significant for the listed traits. Breeder seed of Sakha 101 gave the longest panicles (24.57 and 24.90 cm), highest seed set (97.11 and 99.07 %), greatest one 1000-grain weight (28.41 and 28.47), and yielded highest (11.82 and 12.10 t/ha) in 2016 and 2017 seasons, respectively. foundation seed of the same cultivar produced the second rank of the above-mentioned traits. Breeder seed of Giza 177 rice cultivar resulted in third rank of 1000-grain weigh. Similar results were stated by Sedeek (2001).

Table 5. Means of panicle length (cm), seed set (%), 1000-grain weight (g) and grain yield (t/ha) as affected by rice cultivars, seed classes and their interaction

Main effect and interaction	Panicle length (cm) 2016	Panicle length (cm) 2017	Seed set (%) 2016	Seed set (%) 2017	1000-grain weight (g) 2016	1000-grain weight (g) 2017	Grain yield (t/ha) 2016	Grain yield (t/ha) 2017
Cultivar (A)								
Sakha 101	22.43a	22.99a	95.01a	96.63a	27.40a	27.49a	10.51a	10.83a
Giza 177	21.42c	21.52c	94.51b	96.11b	26.25b	26.36b	8.59c	9.40c
Giza 178	22.00b	22.27b	94.26c	95.14c	22.93c	23.10c	9.82b	10.16b
F- Test	**	**	**	**	**	**	**	**
Class (B)								
Breeder	24.08a	24.35a	96.29a	97.72a	26.25a	26.70a	10.97a	11.34a
Foundation	23.33b	23.68b	95.57b	97.39b	26.04b	26.14b	10.29b	10.69b
Registered	22.40c	22.62c	93.94c	95.29c	25.24c	25.38c	9.74c	10.11c
Farmer	18.00d	18.39d	92.56d	93.91d	24.27d	24.30d	8.05d	8.40d
F – Test	**	**	**	**	**	**	**	**
Interaction (A x B)	**	**	**	**	**	**	**	**

** Significant at level 1 % of probability. In a season, the values having the same letter(s) aren't significantly differ according to Duncan's multiple range test

Table 6. Means of panicle length (cm), seed set (%), 1000-grain weight (g) and grain yield (t/ha) as affected by the interaction between rice cultivars and seed classes

Cultivar (A)	Class (B)	Panicle length (cm) 2016	Panicle length (cm) 2017	Seed set (%) 2016	Seed set (%) 2017	1000-grain weight (g) 2016	1000-grain weight (g) 2017	Grain yield (t/ha) 2016	Grain yield (t/ha) 2017
Sakha 101	Breeder	24.57	24.96	97.11	99.07	28.41	28.47	11.82	12.10
	Foundation	24.04	24.50	96.10	97.95	28.02	28.14	11.17	11.44
	Registered	23.07	23.60	94.08	95.47	27.14	27.24	10.73	11.06
	Farmer	18.06	18.92	92.72	94.07	26.04	26.13	8.35	8.74
Giza 177	Breeder	23.87	24.07	96.04	96.82	27.14	27.27	10.14	10.82
	Foundation	22.90	23.02	95.57	96.27	26.47	26.57	9.56	10.08
	Registered	22.04	22.05	93.69	95.47	26.07	26.13	8.96	9.20
	Farmer	16.90	16.97	92.77	94.29	25.34	25.47	7.16	7.54
Giza 178	Breeder	23.80	24.04	95.74	97.27	24.14	24.37	10.95	11.08
	Foundation	23.06	23.53	95.04	97.97	23.63	23.73	10.16	10.57
	Registered	22.12	22.24	94.08	94.93	22.54	22.77	9.55	10.07
	Farmer	19.03	19.30	92.22	93.37	21.45	21.54	8.65	8.93
LSD 0.05		0.06	0.07	0.11	0.07	0.11	0.07	4.05	0.08
LSD 0.01		0.08	0.10	0.16	0.11	0.07	0.11	6.09	0.13

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دور درجات التقاوي في إنتاجية بعض أصناف الأرز

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أجريت هذه الدراسة في مزرعة محطة البحوث الزراعية بسخا - كفر الشيخ - مصر خلال موسمي زراعة الأرز 2016 و 2017 بهدف دراسة تأثير درجات التقاوي (المربى والأساس و المعتمد وتقاوي المزارع) على الإنتاجية لبعض أصناف الأرز (سخا101 وجيزة 177 وجيزة 178). تم استخدام تصميم القطع المنشقة في ثلاث مكررات حيث اشتملت القطع الرئيسية على أصناف الأرز (سخا101وجيزة 178وجيزة 177) بينما اشتملت القطع الشقية على درجات التقاوي (المربى والأساس و المعتمد وتقاوي المزارع). أوضحت النتائج أن درجة تقاوى المربى أعطت أعلى محصول (10.97 و 11.35 طن للهكتار) في موسم 2016 و 2017 م وللأصناف أعطى أعلى محصول حبوب من الصنف سخا 101 (10.51 و 10.83 طن للهكتار) للموسمين 2016 و 2017. وكان التفاعل بين الأصناف ودرجات التقاوي عالي المعنوية لمتوسط صفات نسبة الإنبات وطول الساق وطول الجذر و عدد الأيام حتى التزهير وعدد الفروع في الجورة و طول ووزن السنبلة و نسبة العقد وعدد الفروع في النبات ووزن الألف حبة ومحصول الحبوب ولكنه غير معنوى مع طول النبات في 2016 و 2017. أوضحت النتائج أهمية اختيار أصناف الأرز و اختيار درجات التقاوي في زيادة إنتاجية محصول الأرز.