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Sakha 107 Egyptian Rice Variety with High Yielding and Good Grain Quality under Water Shortage

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Cross Mark

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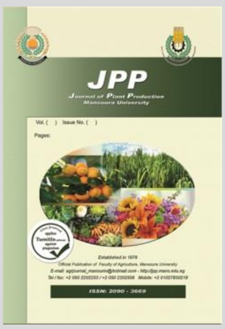

ABSTRACT

Sakha107 was released in 2016 as a high yielding cultivar, good grain quality and short stature with earliness under water shortage in Egypt. Sakha107 was developed from single crossing between Giza 177 and BL1. The cross had initiated in 2000, as F_1 then was forward to F_2– F_5 segregating populations and advanced up to 2006 to reach stability, uniformity and homozygosis up to F6. The promising line GZ8710-3-2-1-1 exceeded all selected lines and was evaluated from 2007 to 2016 in multi-location yield trials, regional, final, verification, DUS, VCU experiments and demonstration yield trials. Sakha 107 cultivar have good agronomical traits *i.e.,* good root system, seedling vigor, tillering ability, short stature, earliness duration 123 day, erect leaves, high leaf area index, high reproductive tillers, large panicles, short grain shape, high grain yield 9.45 and 6.5 t ha^{-1} under both normal and drought conditions ,respectively and straw yield with high harvest index 42.0 % as well as milling, chemicals, cooking characteristics, and resistance to the major diseases such as blast, brown spot, false smut, white tip nematode and Bakanae, in addition to high genetic potential for productivity where the productivity in the demonstration field was 4.3 t/fed and 3.7 t/fed for adjacent field in different governorates during the periods 2017 to 2019 seasons . It is an outstanding new cultivar to released and recommended for cultivation in the various rice-producing regions, mainly in areas that are exposed to declining water irrigation and resources in Egypt.

Keywords: Rice, Variety, Grain yield, Water Saving and Drought Tolerance

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INTRODUCTION

Rice (*Oryza sativa* L.), the staple food crop of half of world population, contributes 27 percent of dietary energy supply, 20 percent of dietary protein and 3 percent of dietary fat in the world diet (FAO, 2002). The rice production areas can be classified into irrigated, which accounts for about 55% of the total rice cultivation area, and rainfed, which consists of upland rice (about 14 Mha, about 11% of the total rice cultivation area), rainfed lowland rice (about 46 Mha in Asia, consisting of 30% of the total rice cultivation area), and deep water rice and floating rice (about 4 Mha in Asia). Global statistics (IRRI, 2002). Rice in Egypt is main cereal crop in summer season with annual cultivated area of about 600.000 ha^{-1}, producing 6.0 million tons of paddy rice. The 10 t ha^{-1} average yield is considered one of the highest values worldwide (RRTC, 2018). Cultivating drought tolerant rice varieties can serve as the most coherent approach to ensure food security therefore, International Rice Research Institute (IRRI) has developed drought tolerant rice varieties possessing high yield along with desirable grain quality via, conventionally bred line, IR74371-70-1-1, has been released (Dar et al. 2020).The semi-aquatic nature of rice and high water requirements for its cultivation make it much more prone to losses from drought than other cereals such as wheat and maize, which are better adapted to be grown with less water. Global agriculture is currently facing two major challenges: an increase in food demand to feed the rapidly growing world population and a decline in global water resource availability. The scarcity of freshwater resources threatens rice production. As a result of the reduction in water availability and recent climate change scenarios, rice production is likely to be more severely affected by drought in Egypt.

Rice yields under severe drought conditions can be reduced by up to 65% in comparison to non-drought conditions. Drought is one of the major causes of low rice yield in Egypt, where rice production is largely irrigated. To reduce yield loss due to drought in the context of climate change, new varieties more resilient to drought and unreliable water supply were developed and introduced. The increasing shortage of water resources has led to the development and adoption of aerobic rice system, which saves water input and increases water productivity by reducing water use during land preparation and limiting seepage, percolation, and evaporation. Aerobic rice also reduces labor requirement and greenhouse gaseous emission from rice field. In an aerobic rice system, the crop can be dry direct-seeded or transplanted and soils are kept aerobic throughout the growing season. Supplemental irrigation is applied as necessary. Aerobic rice cultivars are adapted to aerobic soils and have higher yield potential than traditional upland cultivars. Grain yields of 5–6tha^{-1}can be reached in aerobic rice system. However, yield decline or even complete failure of aerobic rice under continuous cropping threatens the widespread adoption of aerobic rice technology. IRRI has developed drought tolerant varieties which have been released in several countries and are now being planted by farmers. These include Sahbhagi Dhan in India, the Sahod Ulan in the Philippines, and the Sookha Dhan varieties in Nepal. Across these varieties, the average yield advantage of drought tolerant varieties over drought susceptible ones is 0.8-1.2 tons per hectare under drought. For most rice producing countries to attain self-sufficiency, development of high-yielding rice varieties with consumer preferred grain quality features and inbuilt resistance against diseases and insect pests to safeguard the environment is a prerequisite.

Mackill and Khush (2018) released variety IR64 was high yield, early maturity and disease resistance, it had excellent cooking quality, matching that of the best varieties available. It has intermediate amylase content and gelatinization temperature, and good taste. It is resistant to blast and bacterial blight diseases and to brown planthopper .Schiocchet *et al.* (2014) obtained new rice cultivar, SCS118 Marques, through gamma irradiation of SCSBRS Tio Taka cultivar. SCS118 Marques presents modern architecture, lodging resistance, late maturity cycle, moderate resistance to blast, high yield potential, long grains and very high cooking quality. Industrial tests performed with SCS118 Marques showed that grains are suitable for parboiling and white rice, and it is recommended to all rice producing regions of Santa Catarina.

To face meet the food demand under limited water resources, researchers at Egypt Rice Research department bred a new type of rice cultivar characterized by having a yield potential similar to that of the main irrigated lowland rice cultivars in use, but with increased drought tolerance. The development of drought tolerance rice to reduce irrigation water input during rice production has become a critical area of agricultural research in Egypt. In this sense, the rice cultivar Sakha 107 was developed to meet a gap of medium maturity cultivars, with good grain quality and high yield potential.

Therefore, the goal is to present and agronomical describe the irrigated rice cultivar Sakha 107 released and developed by RRTC scholars, recommended for cultivation under water shortage and normal irrigation with the perspective of adoption throughout the Egyptian rice region.

MATERIALS AND METHODS

The rice variety Sakha 107 released (2016) for high yield potential, good grain quality and tolerance to water shortage. The breeding populations were generated using the pedigree method. The pedigree breeding method for Sakha 107 rice cultivar was originated through a single cross having female parent the cultivar Giza 177 from the Rice Research Department and male parent the BL1 from Korean rice varieties. The aim was to gather in this new cultivar good agronomical traits, such as better yield potential, good grain quality, blast resistance and hardiness beside drought tolerance (Figure 1). In 2000, the cross between the adapted and wide spread cultivar Giza177 as female with the Korean cultivar BL1 as male parent was done and produced 50 hybrid seeds, planted in next year as F_1 generation, its progenies were coded by the Breeding Program of RRTC as GZ8710. In 2001 after the planted of F_1 seeds, 500 single plants F_2 generation was sown in the nursery under drought condition (irrigation every ten days has initiated from 15 days from transplanting till 20 days from complete heading and flush irrigation without standing water was used) for the selection of individual plants, resulting in the F_3 progenies (families), every plant sowing in one row have 25 plants, selection have done between and within rows. The 6 single plants were seeded in F_4 generation nursery, each plant represented in family (100 plants) then selection procedure was done between and within families.

2000	Giza177 x BL1 (Hybridization) ▼
2001	F_1 (GZ8710)-50 plants ▼
2002	F_2 (GZ8710)-500 plants ▼
2003	F_3(GZ8710-3)-14 families ▼
2004	F_4(GZ8710-3-2)-6 families ▼
2005	F_5(GZ8710-3-2-1)-26 families ▼
2006	F_n(GZ8710-3-2-1-1)-5 lines ▼
2007 - 2008	Observation and preliminary yield trails under drought conditions
2009 - 2010	Regional and Final yield trails for evaluation under Sakha and Zarzoura locations ▼
2011-2013	Verification and demonstration field trails for evaluation and extension on large scale under drought condition ▼
2014-2015	Distinction, uniformity and stability (DUS), Value of cultivation and use (VCU) ▼
2016 - 2021	Sakha107-Released cultivar and evaluated under demonstrated field in some governorates

Figure 1. Schema illustrated procedures steps for released Sakha 107 cultivar

At 2005 rice growing season, every single plant from 26 plants seeded in family (125 plants) in F_5 generation nursery. The best promising 5 lines were selected and seeded in F_n generation nursery each line about 150 plants.

The procedures to advance F_1, F_2, F_3, F_4, F_5, F_n as well as the observation, primary, regional, final verification and demonstration yield trials were done for evaluation, description, purification, multiplication, uniformity and stability. Evaluation of promising line GZ8710-3-2-1-1 for the Distinction, Uniformity and Stability (DUS) and Value of Cultivation and Use (VCU) tests as variety registration requirements were conducted at 2014 and 2015 rice growing seasons.

Grain yield, duration, plant height, phenotypic acceptability, resistance to biotic stresses and tolerance to drought, were the main criteria to advance selected plants/lines at the different generations. Grain quality, hulling%, milling%, head rice, amylase content % and cooking of promising variety Sakha107 were evaluated according to standard evaluation system (IRRI, 2016).

Field trails evaluation:

Drought condition (flush irrigation every ten days was exposed after 15 days from transplanting till 20 days from complete heading) and amount of water in every irrigation was counted by Metric Counter Measure. During 2007 and 2008 rice growing seasons, the observation and preliminary experiments were conducted to assessed ten promising lines with IET1444 check genotype under drought condition for roots and shoots traits. In addition to, during the 2009 rice growing season the regional yield trail experiment was carried out to evaluate the five promising lines with Giza 177, Sakha 104 and IET 1444 under normal and drought condition for days to heading, grain yield and susceptibility index under Sakha and Zarzoura locations. However, at 2010 rice growing season, the final yield trail experimental carried out to evaluated four new promising lines under both normal and drought condition for days to heading, grain yield, water use efficiency (WUE), blast reaction, and drought susceptibility index (DSI). Concerning the verification yield trail experiment was conducted to test performance of two promising lines with cultivars Sakha 104, Sakha 106 and Giza 178 under both normal and drought conditions for irrigation requirement, duration, grain yield and water use efficiency at 2009 rice growing season. Consequently, the demonstration experiment was conducted to assess the four promising lines *viz.*, GZ 8710-3-2-1-1, GZ 8714-7-1-1-2, GZ 9730-1-1-1-1 and GZ 9730-1-1-3-2 with genotypes IET1444 under normal and drought conditions for root and shoot traits during 2012 and 2013rice growing seasons.

Nevertheless, at 2014 and 2015 rice growing season, the distinction, uniformity and stability (DUS) and value of cultivation use (VCU) experiment were layout to conformities the main characters, duration, plant height and grain yield for GZ8710-3-2-1-1 (Sakha107) compared with three cultivars Sakha 104, Sakha 106 and Giza 178. Meanwhile, the experimental was carried out to comparison two promising lines with Sakha107 (new cultivar) in the demonstration field at some governorates under normal and draught conditions during the periods from 2016 to 2019 rice growing seasons for duration, grain yield, total amount of water and water use efficiency. Regardless, the bed nursery and permanent field were established and prepared according to recommended package of Rice Research and Training Center (RRTC). Phosphorus fertilizer in form of mono-super phosphate (15%) at the rate of 36 kg $P_2O_5ha^{-1}$ and potassium in form of potassium sulphate (48% K_2O) at the rate of 57 kg K_2O ha^{-1}were applied during land preparation. Nitrogen applied by 165 kg ha^{-1} of Urea (46.5% N) in two splits, *i.e.*, two thirds as basal application incorporated into the soil immediately before flooding and one third after 30 days from the first dose. Seedlings were transplanted from nursery to the permanent field after 30 days from sowing at distance spacing (15 x 15 cm) between hills and rows.

Rice varieties were assessment under field verification trails at 2020 and 2021 rice growing seasons under normal and water deficit conditions at three locations i.e. Sakha (Kafr El-Sheikh), Gemmiza (Gharbia) and Zarzoura (Beheira (Governorates, with three replications for each genotype.

Major diseases evaluation:

Behavior of single cross and advanced selected promising lines were evaluated for major diseases infection under field and artificial inoculations under greenhouse condition.

Blast reaction evaluation:

Rice entries including GZ 8710-3-2-1-1(Sakha107), were inoculated with blast isolates in greenhouse conditions to evaluate their blast resistance levels and identify virulent races (if any). Plastic trays (30 x 20 x 12 cm) were partially filled with fine soil, 5g ammonium sulphate were added to each tray. Each tray was planted with 16 entries, and two rows in the ends of each tray as the susceptible check variety Giza 159. Plants were inoculated at 3-4 weeks after sowing. Single isolates were purified and grown on growth medium containing 200 g banana, 15 g glucose, 20 g agar/l medium for spore production. Two hundred ml of spore suspension was prepared from each isolate and adjusted to 5 x10^4 spores/ml. Each season twenty-five isolates were used for inoculation using electrical spray gun. Plants were left in cages for 24 hours with 100% relative humidity, then moved to the incubation room supplied with automatic system for temperature adjustment, between 25-30°C; and relative humidity was maintained at 100% by fine sprinklers. Seven days after inoculation, typical blast lesions appeared and scored using the 0-9 scale SES (IRRI, 2002).

Rice genotypes were tested under field conditions to blast disease at seedling stage under blast nursery (natural infection) at three locations i.e. Sakha (Kafr El-Sheikh), Gemmiza (Gharbia) and Zarzoura (Beheira (Governorates, with three replications for each genotype. Giza 159 was used as a susceptible spreaders a natural source of blast inoculums, while Giza 177 was used as resistant check. The plants were seeded at first week of July in both 2013 to 2014 rice growing seasons. Natural infection was developed and assessed 30-45 days after sowing, using the (0-9) scale according to SES of IRRI (IRRI, 2002). The severity of neck infection symptom was calculated using the formula adopted by Townsend and Huberger (1943).

Brown spot evaluation:

Samples of rice leaves were collected at maximum tillering stage from the tested genotypes. Total number of brown spot lesion was counted on one hundred leaves, which were randomly collected from each plot to calculate severity of infection. After harvest, samples of one hundred grains were taken for estimating the discolored grain percentage according to SES (IRRI, 2002).

Bakanae disease evaluation:

Three genotypes *i.e.,* Sakha107, Sakha104, Giza177 were treated with spore suspension of *Fusarium moniliforme* fungus. Symptoms of bakanae disease became visible about 15 to 20 days after planting. Samples and disease reactions were taken at the nursery (25-30 days after sowing) to ensure the full appearance of bakanae rice disease symptoms. Plant growth parameters *i.e.,* the infected plants (%), dead plants % due to infection, were recorded. Furthermore, tested genotypes were tested under greenhouse with the most aggressive *Fusarium moniliforme* identified isolates. One hundred grains from each rice genotype was soaked in *Fusarium moniliforme* spore suspension (4 x 10^5 spores/ml) for 48 hands incubated for 48 hats 35ºC. Other one hundred grains from each rice entry were soaked in distilled water for 48 hand incubated for 48 hats (35ºC) as check. The treated rice genotypes were cultivated in 15x15 cm diameter pots with three replications and kept in greenhouse at 30-35ºC. The fertilization with urea 46.5% Nat 3g/pot was applied. The number of infected plants was recorded 30 days after sowing.

White-tip nematode evaluation:

Rice samples of hundred flag leaves were randomly collected from each plot before heading to determine severity of infection according to leaf area damage according to SES (IRRI, 2002) .Insect methodology: Parents and advanced promising lines including Sakha107 were evaluated for stem borer infestation as the main insect pest for rice in Egypt. The reaction of evaluated genotypes was classified into five categories according to SES (IRRI, 2002).

Weed control under different methods of transplanting and irrigation intervals:

Two field experiments were conducted during 2015 and 2016 rice growing seasons at the experimental farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, North Nile Delta of Egypt.

The experiment was laid out in a strip split-plot design with three replicates in infested weedy soils. Irrigation intervals were in horizontal plots included; irrigation every three days as a farmer practices (I_1), irrigation every six days (I_2) and irrigation every nine days (I_3). Transplanting methods were located in vertical plots, it was transplanted in flat soil as a traditional method (M_1) and transplanting on bottom of raised-beds (M_2). While weed control treatments were randomly distributed in sub-plots contained; penoxsulam 24% SC (Granite)(W_1), penoxsulam 24% SC + orthosulfamuron 50%WG (Kelion) (W_2)**,** thiobencarb 50% EC **(**Citron) *fb* penoxsulam (W_3), weedy check (W_4) and hand weeding two times (W_5).

Molecular marker analysis:

Assessment and evaluation of genetic diversity of fourteen rice genotypes included Sakha107cultivar by Intron -exon Splice Junction (ISJ) Primers names and sequences are listed in Table1according to Ramadan et al. (2017).

Table 1. List of sequences and summary of ISJ used primers

Primer	Sequences(5′-3′)	TM	NN	Size of bands (bp)	TNB	NPB	P%	PIC
ISJ-1	CAGACCTGCA	32	10	160-867	10	3	30	0.48
ISJ-2	ACTTACCTGAGGCGCCAC	58	18	199-1682	28	24	85.71	0.35
ISJ-3	TGCAGGTCAG	32	10	280-1245	14	6	42.86	0.461
ISJ-5	CAGGGTCCCACCTGCA	56	16	338-1593	10	4	40	0.344
ISJ-7	TGCAGGTCAGGACCCT	53	16	192-2230	25	18	72	0.341
ISJ-9	AGGTGACCGACCTGCA	53	16	373-2098	16	9	56.25	0.289
ISJ-10	ACTTACCTGCATCCCCCT	56	18	350-1513	14	12	85.71	0.36

Demonstration field experiment:

Seventy-five demonstration fields of Sakha 107 rice variety were conducted in five governorates Kafr EL-Sheikh, Shariquia, Beheira, Dakahlia and Gharbia during 2017, 2018 and 2019 seasons from activists of adaptable new rice variety project through cooperation with Academic of Scientific Research and Technology during these periods.

RESULTS AND DISCUSSION

Results:

The cultivar Sakha 107 has biological cycle around 124 days, from emergence to maturity in the Sakha location, being classified as early cycle. High tillering, strong stems and resistant to plant lodging.

The performance and feature GZ 8710-3-2-1 with six rice genotypes and IET1444 Check varieties from the periods 2006 and 2012 rice growing seasons under normal and drought conditions however, the GZ 8710-3-2-1-1 have desirable values for most of the studied characters.

Regardless the five promising lines behavior for days to heading and grain yield drought conditions over two locations Sakha and Zarzoura Research station were illustrated in Table 2. Therefore GZ 8710-3-2-1-1 had earliness 95.2, 94.00, 92 and 91 days to heading under normal

(Sakha and Zarzoura) and drought (Sakha and Zarzoura), respectively. While the grain yield was 10.57 and 10.62 t ha^{-1} for both Sakha and Zarzoura locations under normal condition, respectively. Otherwise under drought condition GZ 8710-3-2-1-1 had the highest values for grain yield were 7.8 and 7.86 t ha^{-1} compare the other promising lines at Sakha and Zarzoura locations, respectively. The susceptibility index is one of important indicators for drought tolerance since the lowest values refers to high tolerance for drought condition, So the five lines GZ 8399-4-1-2-2, GZ 8450-3-1-2-1, GZ 8452-6-1-3-1, GZ 8710-3-2-1-1 and GZ 8714-7-1-1-2 were showed lowest values for susceptibility index ranged between 0.26 to 0.29 for both locations.

Table 2. Regional yield trail for some promising lines under both normal and drought stress conditions over two locations during 2009 rice growing season

Entry	Days to heading				Grain yield (t ha^{-1})				Susceptibility index	
	N		D		N		D			
	Sakha	Zarzoura	Sakha	Zarzoura	Sakha	Zarzoura	Sakha	Zarzoura	Sakha	Zarzoura
GZ 8399-4-1-2-2	97.00	100.00	95.00	96.00	10.30	10.38	7.57	7.42	0.27	0.29
GZ 8450-3-1-2-1	100.00	98.00	97.00	94.00	10.40	10.35	7.78	7.62	0.25	0.26
GZ 8452-6-1-3-1	99.00	101.00	95.00	93.00	10.33	10.30	7.60	7.55	0.26	0.27
GZ 8710-3-2-1-1	95.20	94.00	92.00	91.00	10.57	10.62	7.80	7.86	0.26	0.26
GZ 8714-7-1-1-2	100.20	100.00	99.00	98.00	10.53	10.61	7.66	7.68	0.27	0.28
Giza177	95.2	94.8	92.00	93.2	9.8	9.7	6.50	6.45	0.34	0.34
Sakha104	105.4	104.6	101.1	102.1	10.5	10.4	6.80	6.78	0.35	0.35
IET1444	106.3	105.4	104.3	104.6	8.2	8.1	7.00	6.84	0.15	0.16
LSD 0.05	2.16	2.22	2.04	1.94	0.90	0.89	0.62	0.62	0.38	0.39
LSD0.01	3.16	3.26	2.99	2.85	1.32	1.31	0.91	0.91	0.56	0.56

With respect to the four promising lines performance under final yield trail for days to heading, grain yield, water use efficiency, blast reaction and drought susceptibility index during 2010 rice growing season under normal and drought conditions were given in Table 3. However, GZ 8710-3-2-1-1 had earliness 93.0 and 91.17 days to heading under normal and drought conditions, respectively with reduction percentage 1.97%. The grain yield was 10.33 and 8.05 t ha^{-1} under normal and drought condition, respectively with reduction percentage 22.07%. Nevertheless, GZ 8710-3-2-1-1 had the highest values for water use efficiency 0.99 under drought condition compare the other promising lines during 2010 rice growing seasons. All four promising lines were exhibited resistance to blast disease. The four lines were showed lowest values for susceptibility index comparing with Giza177 as susceptibility cultivar.

Table 3. Final yield trail for four promising lines under both normal and drought stress conditions during 2010 rice growing season

Lines	Days to heading		red.	Grain yield t ha^{-1}		red.	WUE		Blast reaction	DSI
	N	D	%	N	D	%	N	D		
GZ 8452-6-1-3-1	97	92.33	4.81	9.13	7.47	18.18	0.69	0.90	R	0.18
GZ 8710-3-2-1-1	93	91.17	1.97	10.33	8.25	20.14	0.78	0.99	R	0.20
GZ 8714-7-1-1-2	99.5	96.5	3.02	10.13	8.04	20.63	0.76	0.97	R	0.21
GZ 9724-11-2-1-2	102	99.17	2.77	9.5	7.19	24.32	0.71	0.86	R	0.24
Giza177	95	93	2.11	9.8	6.7	31.63	0.74	0.80	R	0.32
IET1444	105	104	0.95	8.2	7	14.63	0.62	0.84	R	0.15
LSD 0.05	2.46	2.44		1.15	1.27		0.22	0.4		0.08
LSD0.01	3.61	3.57		1.68	1.86		0.33	0.58		0.16

The results in Table 4 showed that the irrigation requirement, duration, grain yield and water use efficiency for verification field under normal and drought conditions for two promising lines GZ 8710-3-2-1-1 and GZ 8714-7-1-1-2 compare with three check cultivars Sakha104, Sakha106 and Giza178 at 2011 rice growing season. The mean irrigation requirement value for two lines was 13.09 and 8.57 M^3/ha^{-1}. Also, 13.33 and 8.57 under normal and drought, respectively. The two promising lines were shortest duration under normal and drought conditions compare with three checks cultivars. The grain yield mean values were 10.31 and 8.45 t ha^{-1} more than checks cultivars mean values were 10.23 and 6.75 t ha^{-1} under normal and drought conditions, respectively. The water use efficiency for promising lines under normal and drought condition were more than checks cultivars.

Table 4. Determine irrigation requirement, duration, grain yield and water use efficiency for two promising lines and three checks cultivars at verification field trail during 2011 rice growing season.

Line/ variety	Irrigation requirement (m^3ha^{-1})		Duration (day)			Grain yield (t ha^{-1})			WUE (kg/m^3)	
	N	D	N	D	red%	N	D	red%	N	D
GZ 8710-3-2-1-1	13.09	8.57	123	121	1.63	10	8.33	17	0.72	0.98
GZ 8714-7-1-1-2	13.33	8.57	129	126	2.33	10.63	8.56	20	0.76	1.01
Mean	13.21	8.57	126	123.5	2.00	10.31	8.45	18	0.78	1
Sakha 104	13.80	8.81	135	132	2.22	10	6.7	33	0.7	0.72
Sakha 106	13.33	8.57	124	123	0.81	10.23	6.42	37.24	0.72	0.73
Giza 178	13.80	8.81	135	132	2.22	10.47	7.14	32	0.73	0.75
Mean	13.69	8.69	132	129	1.75	10.23	6.75	34	0.74	0.75
LSD 0.05	1.17	0.74	3.20	3.00		0.71	1.31		0.20	0.51
LSD0.01	1.71	1.09	4.69	4.40		1.04	1.92		0.29	0.74

Concerning root characters in Table 5 during 2012 and 2013 rice growing seasons, the all four lines GZ 8710-3-2-1-1, GZ 8714-7-1-1-2, GZ 9730-1-1-1-1and GZ 9730-1-1-3-2 had desirable mean values for root length, root volume, number of roots plant^{-1} and root/shoot ratio compare with IET1444 check genotype under normal and drought conditions. The GZ8710-3-2-1 was shortest duration 95 and 93 days to heading than other lines and check under normal and drought condition.

All lines seam semi-dwarf and plant height was ranged 98 to 107 cm under normal also, 95 to 100 cm under drought condition. The desirable mean performance for number of tillers plant^{-1}, leaf rolling, flag leaf area and relative water content under both normal and drought conditions for four lines compare with check cultivar IET1444 at 2015 rice growing season. Regardless the grain yield and related components the four promising lines were superior performance for number of panicles/plant, 100-grain weight, water use efficiency and grain yield t ha^{-1} and obtained lowest values for sterility percentage under normal and drought conditions at 2015 rice growing season.

Table 5. Mean performance of some promising lines under demonstration field trail over average of 2012 and 2013 rice growing seasons

Entry	Root length(cm)		Root Volume (ml)		Number of roots / plant		Root/ shoot ratio		Days to heating (day)	
	N	D	N	D	N	D	N	D	N	D
GZ 8710-3-2-1-1	27	25	75	60	243	178	0.8	0.7	95	93
GZ 8714-7-1-1-2	29	27	80	55	303	240	0.9	0.8	98	96
GZ 9730-1-1-1-1	30	28	83	65	317	188	1.3	0.9	105	100
GZ 9730-1-1-3-2	25	23	65	55	238	190	1.1	0.9	100	96
IET1444	26	22	75	59	318	175	0.8	0.6	105	101
LSD 0.05	1.95	2.13	3.48	2.71	8.43	6.84	0.62	0.41	2.79	2.41
LSD0.01	2.86	3.12	5.11	3.98	12.35	10.03	0.91	0.59	4.09	3.53

Table 5. Cont'd.

Entry	Plant height (cm)		Tiller numbers/ plant		Leaf rolling		Flag leaf area (cm^2)		RWC	
	N	D	N	D	N	D	N	D	N	D
GZ 8710-3-2-1-1	100	98	28	22	1	3	28.2	25	82.1	67.1
GZ 8714-7-1-1-2	100	95	26	23	1	3	22.3	18.9	84.7	79.1
GZ 9730-1-1-1-1	107	99	25	23	3	3	25	18.3	61.1	55.6
GZ 9730-1-1-3-2	98	97	27	24	3	3	26.3	19	73.8	68.4
IET1444	105	100	23	18	1	3	21.9	19.7	93.7	76
LSD 0.05	2.60	1.95	1.85	2.04	1.39	0.00	2.18	2.20	4.67	4.24
LSD0.01	3.81	2.86	2.71	2.99	2.04	0.00	3.19	3.23	6.85	6.21

Table 5. Cont'd.

Entry	Number of panicles/ plant/		Sterility percentage		100-grain weight (g)		WUE		Grain yield (t/ha^{-1})	
	N	D	N	D	N	D	N	D	N	D
GZ 8710-3-2-1-1	26	21	8	11	2.6	2.54	0.63	0.94	10.47	8.33
GZ 8714-7-1-1-2	24	21	10	14	2.68	2.4	0.66	0.92	10.25	8.27
GZ 9730-1-1-1-1	23	20	8	11	2.76	2.4	0.64	0.97	10.31	8.23
GZ 9730-1-1-3-2	25	22	7	12	2.61	2.35	0.64	0.92	10.34	7.85
IET1444	22	15	8	11	2.36	2.28	0.59	0.78	8.76	6.66
LSD 0.05	1.67	2.22	1.39	1.52	0.52	0.41	0.21	0.36	0.58	0.75
LSD0.01	2.45	3.25	2.04	2.23	0.76	0.60	0.31	0.53	0.86	1.11

The data in Table 6 exhibited the duration, grain yield, yield components and grain quality for GZ 8710-3-2-1-1 with the rice cultivars Sakha 104, Sakha 106 and Giza 178. Otherwise, the GZ8710-3-2-1-1 had highest mean values for grain yield and grain quality compare with other cultivars. Noted the Giza178 gave the highest mean values for grain yield followed IET 1444 under normal condition. For DUS the results of Central Administration to Seed Certificate indicated that the Line GZ 8710 was distinct, uniformity and stability during the two seasons.

Table 6. Distinction, uniformity and stability (DUS) and Value cultivation of utilization (VCU) under normal conditions as combined over 2014 and 2015 rice growing seasons.

Variety	Total duration (day)	No. of panicle /plant	Panicle length (cm)	Panicle weight (g)	Filled grain / panicle	Seed set %	1000 grain weight (g)	Mean yield (g/day)	Grain yield t/ fed	Hulling %	Milling %	Head Rice %
Giza 178	134.66	19.40	25.59	3.73	182.66	96.31	22.2	35.261	4.748	83.27	70.50	60.50
Sakha 107	122.33	16.83	23.50	3.72	142.67	92.32	28.12	34.828	4.261	86.66	72.66	65.00
Sakha 108	135.00	21.00	23.01	4.89	153.16	92.65	28.60	35.513	4.794	86.67	73.33	67.00
IET 1444	140.33	21.36	25.45	3.51	137.88	93.45	23.23	29.882	4.193	83.26	70.33	46.66
LSD 0.05	0.919	0.982	0.415	0.159	4.576	3.654	0.124		0.087	0.126	1.084	1.133
0.01	1.308	1.397	0.590	0.226	4.602	5.197	0.176		0.124	0.179	1.543	1.612

With respect to data in Table 7 illustrated gab between three new promising lines mean performance for duration, grain yield, amount of water and water use efficiency under drought condition with national average under normal condition. The lines had shortest duration n 124 day, decrease yield 8.57 t ha^{-1} and amount of water use 8568 m^3 ha^{-1} and highest values of water use efficiency 1.00 compare with national average had 125-135 days, 9.52 t ha^{-1}, 13804 m^3 and 0.66 for duration, grain yield, amount of water use and water use efficiency, respectively.

With respect to figure 2, showed the performance the sakha107 under preliminary yield,demonstration field, extension field experiments and feature of panicle size and grain shape.

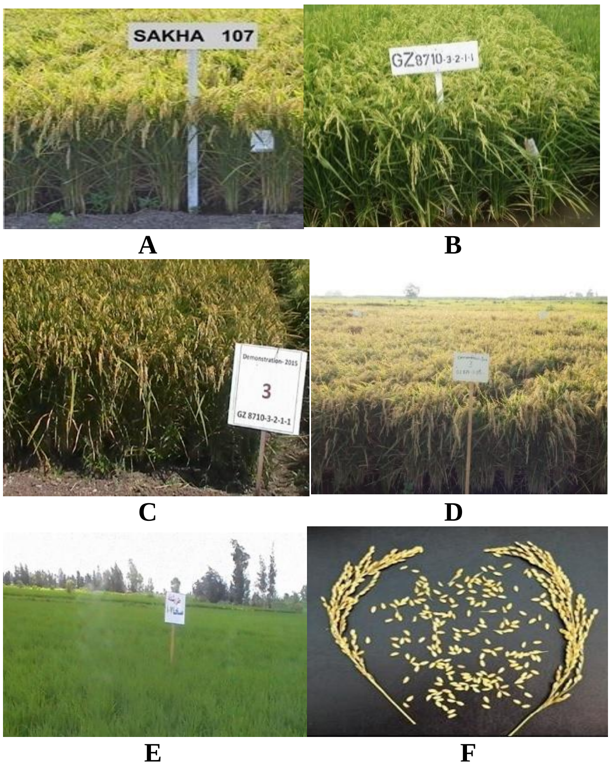

Figure 2. Sakha107 A and B under preliminary yield trails; C and D under drought and normal demonstration field trail, respectively; E is under extension field experiments; F is feature ofpanicle size and grain shape

Table 7. Gab between the new lines and local varieties during 2016 rice growing season

Varity	Duration (day)	Grain yield (t ha^{-1})	The amount of water use (m^3)	WUE
GZ 8452-6-1-3-1	125	8.57	8806.00	0.97
GZ 8710-3-2-1-1(Sakha107)	122	8.33	8330.00	1.00
GZ 8714-5-2-2-1	126	8.57	8568.00	1.00
Mean	124	8.57	8568.00	1.00
National average	125 -135	9.52	13804.00	0.66

Concern the average performance for varieties behavior for days to heading and grain yield during 2020 and 2021 rice-growing seasons under normal and drought conditions over three locations Sakha, Gemmiza and Zarzoura Research stations were illustrated in Table 8. Therefore Sakh107 had earliness values for days to heading under normal (Sakha, Gemmiza and Zarzoura) and drought (Sakha, Gemmiza and Zarzoura), respectively. While the grain yield was 10.65, 10.63 and 10.70 t ha-1 for the three locations under normal condition, respectively. Otherwise, under drought condition Sakha 107 had the highest values for grain yield were 7.86, 7.85 and 7.92 t ha^{-1} compare the varieties at Sakha, Gemmiza and Zarzoura locations, respectively.

Diseases survey:

Three rice genotypes including GZ8710-3-2-1-1, Giza177 and Giza159 were tested under greenhouse and field conditions to access their blast resistance levels. The reaction of tested rice genotypes under 25 isolates of rice blast are presented in Table 9. The results show that the 25 isolates were represented 8 races as follow; the IG-1 race (6 isolates), IC-13 race (5 isolates), IC-8 (4 isolate), both ID-5 and ID-7 races (3 isolates), IH race (2 isolates), both IB-45 and IF-4 races (one isolates). The results indicated that rice varieties GZ8710-3-2-1-1 and Giza177 were resistant to all rice blast races under greenhouse and field conditions. The cultivars Giza159 was susceptible under both greenhouse and field conditions.

Table 8. Verification yield trail for the rice varieties under both normal and drought stress conditions over three locations during 2020 and 2021 rice growing seasons

Entry	Days to heading						Grain yield (t ha^{-1})					
	N			D			N			D		
	Sakha	Gemmiza	Zarzoura	Sakha	Gemmiza	Zarzoura	Sakha	Gemmiza	Zarzoura	Sakha	Gemmiza	Zarzoura
Sakha107	94.85	94.66	94.75	92.74	92.55	91.73	10.65	10.63	10.70	7.86	7.85	7.92
Giza177	95.96	95.77	95.56	92.74	92.55	93.95	9.88	9.86	9.78	6.55	6.54	6.50
Sakha104	106.24	106.03	105.44	101.91	101.70	102.92	10.58	10.56	10.48	6.85	6.84	6.83
IET1444	107.15	106.94	106.24	105.13	104.92	105.44	8.27	8.25	8.16	7.06	7.04	6.89
LSD 0.05	2.18	2.17	2.24	2.06	2.05	1.96	0.91	0.91	0.90	0.62	0.62	0.62
LSD0.01	3.19	3.18	3.29	3.01	3.01	2.87	1.33	1.33	1.32	0.92	0.92	0.92

Table 9. Reaction of leaf blast disease for eight tested genotypes under greenhouse and field conditions during 2012-2015 growing seasons

	Blast races under Greenhouse								Blast field reaction			
	IG-1	IB-45	IC-8	IC-13	ID-5	ID-7	IF-11	IH	2012	2013	2014	2015
No of isolate	6	1	4	5	3	3	1	2				
GZ8710-3-2-1-1	R	R	R	R	R	R	R	R	R	R	R	R
Giza177 (R check)	R	R	R	R	R	R	R	R	R	R	R	R
Giza159 (S check)	S	S	S	S	S	S	S	S	S	S	S	S

Brown spot, White tip nematode and Bakanae diseases infestations:

Brown spot %, Brown spot severity % and White tip nematode % of genotypes GZ8710-3-2-1-1, Giza177 and Sakha104 are given in Table 10. The results indicated that, promising line GZ8710-3-2-1-1 gave the lowest brown spot infection, severity and White tip nematode %. On the other hand, the Giza 177 and Sakha 104 gave the moderate infection percent of brown spot and white tip nematode. Concerning Bakanae rice disease under natural infection, the Sakha104 gave the lowest infection under both non-inoculated and inoculated (0.75 and 25.16 % respectively). GZ8710-3-2-1-1and Giza177 showed the lowest bakanae infection percentage 0.13 % under non-inoculated conditions and 11.28 % and 23.04 % under artificial inoculation conditions, respectively.

Table 10. Mean performance of some rice genotypes as affected by some rice diseases at the two seasons 2013 and 2014

Genotype	Brown spot %		Brown spot severity		White tip nematode %		Bakanae %	
	2012	2013	2012	2013	2012	2013	Non-inoculated	inoculated
GZ8710-3-2-1-1	7.68	8.01	36.02	37.73	0.15	0.20	0.13	11.28
Giza177	60.76	61.89	289.59	292.82	32.59	33.81	0.13	23.04
Sakha104	66.18	65.17	299.68	302.33	55.35	58.95	0.75	25.16
L.S.D 05 %	3.62	4.17	10.16	9.10	4.83	4.05	0.99	10.74

Effect of irrigation intervals, transplanting methods and weed control treatments and their interactions on number of panicles/m2, number of filled grains per panicle, 1000-grain weight and grain yield of rice during 2015 and 2016 seasons.

Data in Table 11 show that there are highly significant effects of irrigation intervals, transplanting methods and weed control treatments on dry weight, number of panicles/m^2, number of filled grains/panicle, 1000-grain weight and grain yield of rice in the two growing seasons.

Irrigation every three days (I_1) exceeded the two rest irrigation intervals in all abovementioned traits in both seasons, except for number of panicles per square meter in the first season which significantly equaled with I_2. Irrigation interval I_3 reduced rice grain yield by 17.6 % and 14.2 % compared to I_1 and I_2, respectively as mean of the two growing seasons. These results are similar to those reported by Bajavathiannan *et al*., (2011) Mahmoud (2015) and Abou El-Darag *et al*., (2017).

The ordinary analysis of variance Table 11 showed significant differences of yield and its components between transplanting methods. The highest values of dry weight, number of panicles/m^2, number of filled grains/panicle and grain yield of rice in addition to 1000-grain weight were recorded by traditional transplanting method (M_1) through both growing seasons compared to raised-bed transplanting (M_2). Grain yield of transplanting method (M_1) increased by 7.1 % compared to (M_2) as mean of the two growing seasons. Bajavathiannan *et al*., (2011) found that rice grain yields recorded by flooded plots were higher than yields of furrow-irrigated plots by 13 to 14%.

Table 11. Means of rice dry weight, number of panicles, filled grains per panicle and 1000-grain weight and grain yield of rice as affected by irrigation intervals, transplanting methods and weed control and their interactions in 2015 and 2016 seasons.

Factor	Rice dry weight g m^{-2}		No. of panicles m^{-2}		No of filled grains per panicle		1000-grain Weight g		Rice grain yield t ha^{-1}	
A-Irrigation interval:	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
I_1	1124.7 a	1277.5 a	473.0 a	505.2 a	89.9 a	90.6 a	25.7 a	27.1 a	8.00 a	8.52 a
I_2	1076.4 b	1225.1 b	471.1 a	493.8 b	89.0 b	88.3 b	25.5 a	26.5 b	7.65 b	8.20 b
I_3	920.0 c	1112.2 c	435.3 b	452.2 c	85.1 c	82.7 c	24.8 b	25.4 c	6.45 c	7.15 c
F. test	**	**	**	**	**	**	**	**	**	**
B-Transplanting method:										
M_1	1087.4 a	1298.9a	475.0 a	507.3 a	89.5 a	88.5 a	25.6 a	26.9 a	7.78 a	8.11 a
M_2	993.3 b	1110.8 b	444.6 b	460.1 b	86.6 b	85.9 b	25.0 a	25.8 b	6.96 b	7.80 b
F test	**	*	*	*	**	*	NS	*	**	*
C- Weed control:										
W_1	970.8 d	1185.5 c	443.0 c	485.7 c	84.3 c	82.7 c	24.6 d	26.0 c	7.77 c	7.75 c
W_2	1111.1 c	1304.4 b	494.5 b	518.2 b	91.9 b	89.5 b	26.3 c	27.1 b	8.42 b	8.60 b
W_3	1327.6 a	1450.3 a	517.7 a	563.0 a	103.7 a	103.1 a	28.1 a	28.7 a	9.04 a	10.20 a
W_4	589.9 e	763.0 d	318.8 d	329.2 d	68.9 d	70.9 d	21.2 e	22.7 d	3.29 d	4.55 d
W_5	1202.6 b	1321.3 b	495.0 b	522.4 b	91.3 b	89.9 b	26.6 b	27.1 b	8.33 b	8.67 b
F test	**	**	**	**	**	**	**	**	**	**
Interactions:										
I x M	NS	NS	**	**	NS	NS	NS	NS	NS	NS
I x W	*	*	NS	NS	NS	NS	NS	NS	**	**
M x W	*	**	NS	NS	NS	NS	NS	NS	*	**
I x M x W	NS	NS	NS	NS	NS	NS	NS	NS	*	**

***, **, N.S indicates P< 0.05, P< 0.01 and not significant, respectively. Means of each factor within each column, values followed by the same letters are not significantly different at 5% level, using DMRT.**

Data in Table 11 also showed that there are significant differences of rice dry weight, number of panicles/m^2, number of filled grains/panicle, 1000-grain weight and grain yield among different weed control treatments. The highest significant positive effect on grain yield, number of panicles/m^2, number of filled grains/panicle and 1000-grain weight was recorded by W_3 weed control treatment compared with rest weed control treatments of the two-growing seasons. Rice grain yield and its components had the descending order $W_3 > W_5 = W_2 > W_1 > W_4$ in the two growing seasons. Rice dry weight appeared significant response to the interaction of I x M and M x W in both seasons of the study. Except for I x M interaction, number of panicles/m^2 didn't show any significant response under rest interactions, number of filled grains per panicle and 1000-grain weight also didn't show any significant differences under all interactions in the two growing seasons While, grain yield was significantly affected by I x W, M x W and I x M x W interactions in both growing seasons. Bajavathiannan *et al*., (2011) reported that weed control was greater in the flooded system compared with the furrow-irrigated system (up to 20% greater), because flooding effectively prevented the emergence of most terrestrial weeds. These findings are in harmony with those obtained by Singh *et al*., (2006) and Abd El-Naby *et al*., (2017).

Rice stem borer (Chilo agamemnon Bleszynski):

Rice stem borer attacks rice plants causing two symptoms, first one (dead hearts) during vegetative stage, and second is (white heads) during reproductive stage. However, most damage is due to white heads.

From 2015 to 2019 rice seasons, a rice variety Sakha 107 with some local varieties that evaluate to rice stem borer and rice leaf miner. These varieties were sown under natural infection at the Rice Research & Training Center (RRTC) farm, Sakha, Kafr El-Sheikh, Egypt. At all growing seasons, all cultural practices such as nurseries and permanent field preparation, transplanting, fertilization, …. etc. were applied as recommended except insecticides.

Rice leaf miner (*Hydrellia prosternalis* Deeming):

Most rice varieties worldwide susceptible to the rice leaf miner very few are resistant. Throughout the 2017-2021 rice seasons of evaluation to rice leaf miner infestation, revealed that, Sakha 107 is moderately resistant to rice leaf miner when sown after 15 May and tends to be almost free from infestation when sown early in the season (during the end of April to 15 May).

Data in Table 12 present the susceptibility of Sakha 107, as well as local varieties, to the rice stem borer. Both Sakha 107 and Sakha 101 were resistant to the stem borer throughout the 2017-2021 seasons of evaluation having averages of 2.64 and 2.29% stem borer infestation, respectively. Giza 179 exhibited 3.24% infestation, while the most susceptible cultivar was Giza 178 (6.72%).

Table 12. Rice varieties Susceptibility to rice stem borer

Variety	2017	2018	2019	2020	2021	Av.
Sakha 107	2.30	2.40	2.39	3.48	2.65	2.64
Sakha 101	1. 96	1.97	2.20	2.40	2.60	2.29
Giza 179	3.90	2.56	2.97	3.32	4.09	3.24
Giza 178	5.90	6.54	6.63	6.50	7.20	6.72

The results revealed that agronomical traits were significantly affected by irrigation regimes as shown in Table 13. Most of agronomical traits significantly decreased as irrigation intervals increased up to 12-day. Sakha107 was the tallest plant and produced the heaviest 1000-grain weight (g). Sakha 107 produced the highest values of number of effective tiller hill^{-1}and unfilled grains percentage .On the other hand, Giza 179 produced the highest values of panicle length, panicle weight and number of filled grains panicle^{-1}, grain as well as straw yield under normal condition. Generally, irrigation every 12 day achieved the highest values of water use efficiency (WUE) while, Sakha 107 gave the highest values of WUE.

Table 13. Mean performance of Sakha107 and Giza179 under four irrigation intervals for agronomic and grain quality traits (Gewaily *et al*. 2019).

Traits	Sakha 107				Giza 179			
	I_1	I_2	I_3	I_4	I_1	I_2	I_3	I_4
Plant height (cm)	98.23	94.55	91.80	87.21	87.53	84.25	81.80	77.71
No. of effective tiller hill^{-1}	23.43	22.56	21.90	20.81	21.94	21.12	20.50	19.48
Panicle length (cm)	18.83	18.13	17.60	16.72	22.47	21.63	21.00	19.95
Panicle weight (g)	2.77	2.67	2.59	2.46	2.92	2.81	2.73	2.59
1000-grain weight (g)	27.29	26.27	25.50	24.23	27.18	26.16	25.40	24.13
No. of filled grains panicle^{-1}	100.9	97.13	94.30	92.59	107.00	103.00	93.00	90.00
Unfilled grains %	5.95	6.26	6.45	6.70	7.61	8.01	8.25	8.57
Grain yield (t ha-1)	10.48	9.13	8.86	8.42	11.06	9.30	8.03	7.58
Straw yield (t ha-1)	11.56	11.12	10.80	10.26	12.05	11.57	10.20	9.59
Hulling %	87.21	83.95	81.50	77.43	81.43	78.38	76.10	72.30
Milling %	83.14	80.03	77.70	73.82	75.11	72.31	70.20	66.69
Head rice %	72.12	69.42	67.40	64.03	59.17	56.96	55.30	52.54
Total water use(m^3 ha^{-1})	13566	11781	9896	8484	13566	11781	9896	8484
Water saved %	-	9.09	23.64	34.53	-	9.03	23.58	34.48
Yield reduction %	-	5.39	15.41	20.34	-	4.13	23.48	30.18
Water use efficiency (kg m^{-3})	77.25	77.50	89.53	99.25	81.53	78.94	81.14	89.34
Grain length (mm)	5.00	4.80	4.73	4.40	5.53	5.50	5.40	5.33
Grain width (mm)	2.86	3.03	3.00	3.06	2.53	2.50	2.66	2.46
Grain bulk density (g/cm^3)	0.76	0.78	0.80	0.84	0.70	0.74	0.78	0.78
Grain whiteness index(WI)	74.75	74.33	73.75	73.63	72.87	72.16	71.38	69.63
Grain chalky grains %	0.72	1.23	1.50	3.31	1.18	5.16	5.58	5.77
Grain moisture (%)	13.50	13.43	13.02	12.94	13.90	13.81	13.77	13.76
Grain ash (%)	0.40	0.47	0.47	0.50	0.60	0.63	0.64	0.66
Grain protein (%)	5.41	5.30	5.26	5.20	7.47	7.27	7.17	6.95
Grain fat (%)	0.80	0.82	0.82	0.82	0.72	0.72	0.76	0.77
Grain crude fiber (%)	0.52	0.52	0.53	0.53	1.13	1.16	1.17	1.16
Total carbohydrate (%)	92.87	92.89	92.92	92.95	90.08	90.22	90.26	90.46
Amylose %	17.44	17.45	17.46	17.45	18.50	18.51	18.52	18.51
Water uptake ratio	1.71	1.74	1.76	1.78	1.80	1.83	1.86	1.90
Cooking time (min)	15.00	18.00	20.00	23.00	17.00	19.00	22.00	25.00
Volume increase ratio	1.58	1.61	1.57	1.70	2.10	2.14	2.16	2.19
Elongation ratio	1.20	1.22	1.25	1.27	1.31	1.35	1.37	1.39
Color	8.70	8.50	8.40	8.48	7.82	7.97	7.88	7.82
Flavor	8.50	8.70	8.70	8.70	7.55	7.60	7.60	7.55
Taste	8.60	8.60	8.60	8.61	8.15	8.20	8.10	8.15
Fluffy	7.40	7.41	7.43	7.43	8.08	8.08	8.10	8.15
Softness	8.59	8.64	8.63	8.62	8.61	8.63	8.63	8.70

I_1= continuous flooding,I_2= irrigation every 6-day,I_3= irrigation every 9-day,I_4= irrigation every 12-day.

Under the irrigation every nine and twelve day treatments, Sakha 107 gave the highest grain yield, less reduction in grain yield percentage and highest WUE compared to the other varieties. Sakha 107 had the highest values of grain width, bulk density, whiteness index and total carbohydrate content, while it was contained the lowest values of chalky grains%, cooking time and amylose content, as well as the highest scores in color, flavor and taste compared to the other varieties. It could be concluded that Sakha 107 rice variety produced the highest grain yield, WUE, highest scores in flavor and taste, lowest values of chalky grains percentage and lowest cooking time when irrigation regime was prolonged to every 9 and12 day compared to the other varieties. Thus, Sakha 107 can be cultivating in limited water supplies areas or in the ends of terminal irrigation .Gewaily, *et al.* (2019)

A total of 12 intron-exon splice junctions (ISJ) primers for screening fourteen Egyptian rice genotypes, including six Japonica, four Indica and four Indica/Japonica rice genotypes. A total of 117 amplified fragments were generated among which 76 fragments were polymorphic revealing average polymorphic ratio of 58.9%. Number of amplified fragments per genotype across the primers ranged from 65 in Japonica rice variety Sakha101 to 85 in Indica/Japonica rice variety Giza179. Number of polymorphic amplified fragments ranged from 3 for primer ISJ-1 to 24 for *primer ISJ-2. (Ramadan et al. 2017).*

The average numbers of amplified bands per primer per genotype were 16.71 and 10.24, respectively. Polymorphic information content (PIC) values ranged from 0.289 for ISJ-9 to 0.480 for ISJ-1 with an average of 0.375. The coefficient of similarities based on semi-random data among the studied genotypes ranged from 0.53 to 0.9 with an average of 0.66.

All genotypes clearly grouped into two major clusters in the dendrogram at 58% similarity based on Jaccard's similarity index (Figure 3). The first cluster represents the Indica and Indica/Japonica rice genotypes, while the second cluster represents the Japonica genotypes. These results indicate that fingerprinting using semi-specific DNA markers may be an efficient tool for varietal identification and assessing genetic diversity in rice.

The results highlight the existing diversity among the studied genotypes and hence their potential use inbreeding programs. The simplicity and reproducibility of ISJ markers indicates the potential utilization for molecular characterization, identification and purity assessment of rice genotypes. In addition to, data recorded the lowest similarity coefficient was observed between Sakha107 and the high yielding rice variety Sakha101meanwhile, the highest similarity coefficient was observed between the Indica/ Japonica line GZ6296-12-1-2-1-1 and the Japonica variety Sakha107, therefore the sub cluster B1 included both rice genotypes Sakha105 and Sakha107.

Demonstration field experiments:

Obtained finding in Table 14 revealed that, the differences among studied varieties were not significant in both demonstration and adjacent field, at the same time the differences in grain yield between demonstration and adjacent field was amounted to be 0.500 t/ha with all tested varieties, the superiority in the yield for demonstration field compared to adjacent it is mainly attributed to optimum of package of recommendation

Table 14. the average grain yield (T/ha.) of Sakha 107 compared to other varieties for demonstration and adjacent field in deferent governorates from the period 2017 to 2019 seasons.

Varieties	2017		2018		2019	
	Demonstration	Adjacent	Demonstration	Adjacent	Demonstration	Adjacent
Sakha 107	4.17a	3.67a	4.290a	3.86a	4.310a	3.92a
Sakha 106	4.12a	3.62a	4.240a	3.74a	4.260a	3.83a
Giza 177	4.05ab	3.55ab	4.170ab	3.63ab	4.190ab	3.78ab
Average	4,236	3,736	4,318	3,818	4,369	3,869
Differences	0,500		0,500		0,500	

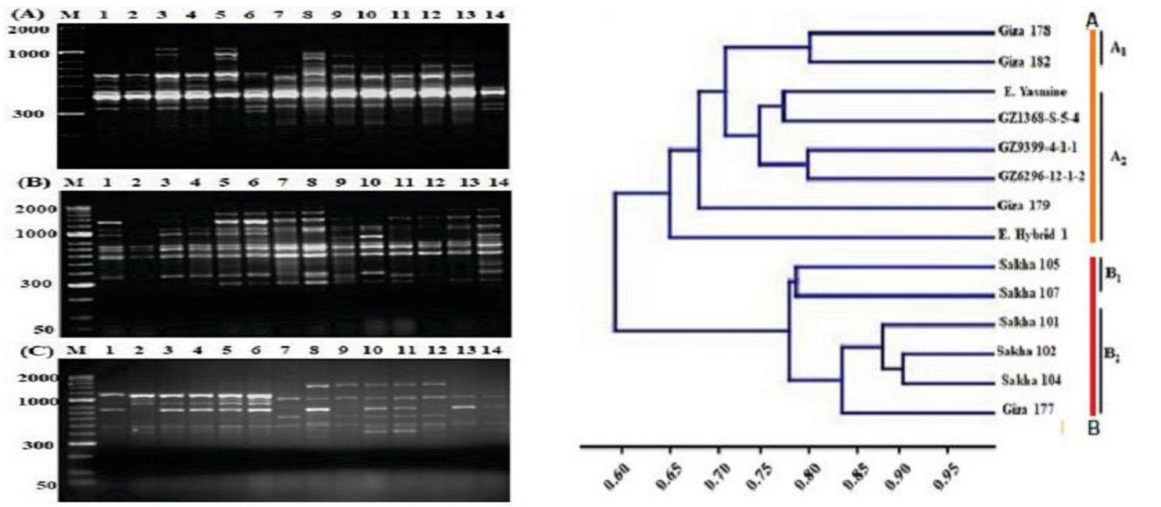

Figure 3. Agarose gel electrophoresis of PCR amplified fragments for the highest polymorphic ISJ markers. ISJ-2 (A), ISJ-7 (B) and ISJ-10 (C). M: 50 bp DNA ladder; 1: Giza177; 2: Sakha101:;3Sakha102; 4: Sakha104; 5: Sakha105; 6: Sakha107; 7: Giza178; 8:Giza179;9:GZ9399-4-1-1-3-2-2;10:GZ6296-12-1-2-1-1;11:Giza182; 12: E. Yasmine; 13: GZ1368- S-5-4 and 14: E. Hybrid1. Dendrogram derived from UPGMA cluster analysis of 14 rice genotypes based on Jaccard's similarity coefficient using ISJ markers according to Ramadan *et al.* (2017).

Obtained finding in Table 15 revealed that, the differences among different governorates were not significant in both demonstration and adjacent field, at the same time the differences in grain yield between demonstration and adjacent field was amounted to be 0,387, 0,541 and 0,619 t/ha with Sakha 107 variety, the superiority in the yield for demonstration field compared to adjacent it is mainly attributed to optimum package of recommendation.

Obtained finding in Table 16 revealed that, the differences among different rice varieties for water requirement, total duration, grain yield and water used efficiency were significant in both seasons, at the same time the differences in grain yield and water used efficiency for Sakha 107 was amounted 8.33 t/ha and 0.98 WUE under drought to be 1o t/ha, and 0.72 WUE under normal condition. That meaning the Sakha 107 variety was the superiority in the yield and WUE under demonstration field compared to adjacent it is also, mainly attributed to optimum package of recommendation.

Table 15. Grain yield (t/fed) of Sakha 107 for demonstration and adjacent field in deferent governorates from the period 2017 to 2019 seasons.

Governorate	2017 Demonstration	2017 Adjacent	2018 Demonstration	2018 Adjacent	2019 Demonstration	2019 Adjacent
Kafr EL-Sheikh	4.242	3.858	4.o85	3.728	4.187	3.625
Shariquia	---------	---	4.461	3.933	4.516	3.890
Beheira	4.230	3.840	4.391	3.766	4.491	3.796
Dakahlia	----	--	4.333	3.683	4.420	3.760
Gharbia	---	--	---	--	4.230	3.680
Average	4.236	3.849	4.318	3.770	4.369	3.751
Differences	0.387		0.541		0.619	

Table 16. Irrigation requirement, total duration, grain yield and water used efficiency as combined from the period from 2017 and 2019 rice growing seasons

Line/ Variety	Irrigation requirement (m^3ha^{-1}) D	Irrigation requirement N	Irrigation requirement Red%	Duration (Day) D	Duration N	Duration Red%	Grain yield ($t\ ha^{-1}$.) D	Grain yield N	Grain yield Red%	WUE D	WUE N
Sakha107	8.57	13.09	34.55	121	123	1.63	8.33	10	16.70	0.98	0.72
Sakha 104	8.81	13.80	36.21	132	135	2.22	6.7	10	33.00	0.72	0.7
Sakha 106	8.57	13.33	35.71	123	124	0.81	6.42	10.23	37.24	0.73	0.72
Giza 178	8.81	13.80	36.21	132	135	2.22	7.14	10.47	31.81	0.75	0.73
LSD 0.05	0.31	0.51		3.17	3.38		1.20	0.62		0.46	0.15
LSD0.01	0.46	0.74		4.64	4.95		1.76	0.91		0.68	0.22

Discussion

Rice is the most important food crop in the world. Major advances have occurred in rice production as a result of the wide-scale adoption of improved rice varieties. However, demand for rice in low-income countries continues to increase because, of increases in the population of rice consumers and improvements in living standards. It is estimated that we will have to produce 50% more rice by 2050. To meet this challenge, we need rice varieties with higher yield potential. Several approaches are being employed for developing rice varieties with increased yield potential, such as population improvement, ideotype breeding, heterosis breeding, wide hybridization, genetic engineering and molecular breeding. Water scarcity one of big challenge to increase rice production by land unit area and increased in rice cultivated area. The breeding to release new rice drought varieties tolerance is one of strategy to overcome limited water sources and deficit.

Sakha107, released in 2016 as a japonica type drought tolerant variety developed from the cross Giza 177 × BL1. It has high yield potential (10.4 tons ha^{-1}) under normal conditions and reasonable yield under drought conditions (about 7.5 tons ha^{-1}). Total growth duration is 125 days and plant height is 106 cm. Sakha 107 is blast resistant and it has short grains, 72% milling outturn, 17% amylose content, and excellent cooking quality. Therefore, the development of multi-tolerant rice genotypes for such abiotic stresses represents the main objective of rice breeders at RRTC.

Many recently released rice varieties were tolerant to a biotic stresses in different levels, such as Giza 178, Giza 179, Egyptian Hybrid 1 and Sakha 107 (Elmoghazy and Elshenawy 2017). The genotypes, GZ 8710-3-2-1-1(Sakha 107), GZ 9730-1-1-1-1, GZ 9730-1-1-3-2 and G Z9781-3-2-2-6 could be considered as drought tolerance rice genotypes and would be promoted to be new rice varieties (Gaballah and Abdallah 2015). Abdallah *et al*. (2016) indicated that the studied varieties significantly differed in root volume and GZ 8710-3-2-1-1 gave the desirable mean values of root volume, root length, root: shoot ratio, root thickness, number of panicles $hill^{-1}$.Gaballah and Abu El-Ezz (2019) found that leaf rolling and sterility percentage increased under heat stress, while days to heading, plant height, number of tillers and number of panicles / plant, 100-grain weight and grain yield/plant decreased under heat stress in comparison to normal conditions. Nevertheless, mean performance Giza 179, Giza 178, Sakha 107 and Sakha 101 surpassed other genotypes in grain yield and its important attributes. Meanwhile, Giza178, Sakha 107 and WAB56-50/Sakha101-1 recorded the lowest values for susceptibility index and yield index which refer to these genotypes highly tolerance to heat stress, while Giza 177 and Sakha 101 gave the highest values to be the most heat susceptible genotypes.

In terms of organic and non-organic fertilization on behavior Sakha 107 rice cultivar performance under irrigation regimes Gewaily *et al.,* (2019) confirmed that the growth,grain yield and its attributes of Sakha 107 rice cultivar, as well as N and P uptake by grain were significantly influenced by irrigation treatments and by inoculation with Arbuscular Mycorrhizal fungi (AMF). Therefore, incubation of AMF increased all parameters compared to control treatment. However, the reductions in grain yield were 3.48, 14.96 and 24.59% with corresponding values of water saved of 6.62, 12.46 and 25.00% when the interval period was prolonged up to 6, 9 and 12-day, respectively. Irrigation every 6 treatment gave the highest values of productivity of irrigation water (PIW) followed by irrigation every 12 days treatment. Inoculation by AMF under irrigation treatments increased the PIW. The application of phosphorus fertilizers, increased the number of tillers / m^2, the number of branches / panicle, filled grains number / panicle, 1000-grain weight (g), grain yield (t ha^{-1}) and straw yield (t ha^{-1}) for Sakha107 variety. Consequently, application of phosphorus as superphosphate or nano-phosphorus enhanced grain quality characteristics as well as nitrogen and phosphorus content in milled grains (Sorourl *et al.* 2020).

In spite of grain quality milling, chemicals and cooked characteristics of Sakha 107 cultivar, Abd El-Raheam (2020) showed that, length, width and thickness of the rice drought variety (Sakha 107) increased linearly with the increasing of grain moisture content, while, shape index-k and coefficient of content surface decreased generally with the increasing of grain moisture content. For the rice milling quality, the head rice yield and degree of whitening increased with the decreasing of rice moisture content and the broken rice percentage increased with the increasing the rice moisture content for both rice varieties Sakha 107 and Giza 177.

Diseases survey experiments were conducted on new cultivar Sakha 107 proven that resistance for all major diseases in rice planted in Egypt, particularly blast, brown spot, false smut, white tip nematode and Backana compare with old verities. Gabr (2004), El-Wahsh and Hammoud (2007) found that Sakha101 and Sakha104 showed susceptible reaction to 20 blast pathogen isolates in a greenhouse test. Concerning natural infection under field conditions, the promising line GZ8710-3-2-1-1 (Sakha 107) and Giza 177 were resistant to all rice blast races under field conditions. Bakana disease, symptoms is the appearance of tall thin plants, markedly over-growing than uninfected plants. The active metabolic product of the pathogen is gibberellins which was isolated and proved to play an important role in the pathogenicity of this organism Li et al. (2005) and Hammoud and Gaber (2014). Giudici *et al*. (2003) showed that *Aphelenchoides besseyi* is a seed transmitted plant parasitic nematode can dramatically affect rice growth and yield. Abdel Hadi *et al*. (2005) reported that the disease is widely spread all over Egyptian governorates, causing remarkable yield reduction in the susceptible old rice cultivars Giza171 and Reiho as well as some new rice cultivars (Giza177, Sakha102 and Sakha103) with different levels of infection and yield losses reaching 47% in old cultivars, as recorded by El-Shafey (2007), who reported the positive effects of seed priming with NaCl solutions and sulfur control the disease.

In order to, the genetic studied conducted on Sakha 107 to determined range of changed in DNA construction by nano-particles and callouses induction Aboulila and Galal (2019)recorded that among different concentrations of silica nanoparticles, the drought tolerant genotypes (Sakha107 and Giza179) gave the highest percentage of genome template stability in 150 ppm, while the drought sensitive genotypes gave the highest percentage on 300 and 450 ppm for Sakha106 and sakha101, respectively. Consequently results confirmed the effects of SiO_2NP and soma clonal variations on mutation and DNA instability and suggested that genomic template stability (GTS) reflecting changes in RAPD profiles was the most sensitive endpoint compared with the traditional indices such as root and shoot growth.

CONCLUSION

The Sakha107 is pioneer rice cultivar to growing and gave high grain yield reach to 10.4 and 8.5 t ha^{-1} under normal irrigation (13000 m^3) and water shortage (8500 m^3) with less reduction in yield and highest water saving cultivar compare with old rice cultivars. Sakha 107 cultivar have good agronomical traits (good root system, seedling vigor, tillering ability, short stature, earliness duration 123 day, erect leaves, high leaf area index, high reproductive tillers, large panicles, short grain shape, high grain and straw yield with high harvest index 44 % as well as milling, chemicals, cooking characteristics, tolerance to lodging and to the major diseases such as blast, brown spot, false smut, white tip nematode and bakanae, in addition to high genetic potential for productivity .Thus, it is an excellent the new cultivar to be release and recommended for cultivation in the different rice-producing regions, particularly area severing from shortage of water irrigation amount and resources in Egypt.

REFERENCES

Abd El-Naby, S. S. M. and M. A. Mahmoud (2018). Enhancing irrigation water productivity of rice using irrigation intervals, transplanting methods and weed control in North Nile Delta. *J. Soil Sci. and Agric. Eng., Mansoura Univ., 9 (1): 11 – 20.*

Abd El-Naby, S. S. M.; I. H. Abou El-Darag and A. M. A. El-Ghandor (2017). Weed management in broadcast-seeded hybrid rice (*Oryza sativa* L.). *J. Plant Production, Mansoura Univ., 8 (10): 1021 – 1028.*

Abd El-Raheam, S. S. (2020). “Physical Properties and Milling Quality of a New Rice Drought Variety.” Misr Journal of Agricultural Engineering 37 (1): 123–36. https://doi.org/10.21608/mjae.2020.94974.

Abdallah, A. A., S. A. Badawy, and A. A. Eliba. (2016). “Response of Some Root and Yield Traits To Water Stress for Some Rice Varieties.” Journal of Sustainable Agricultural Sciences 42 (3): 353–64. https://doi.org/10.21608/jsas.2016.2961.

Abdallah, A.B. (1996). Effect of some cultural treatments on rice. M.Sc., Thesis, Fac., Agric., Moshtohor, Zagazig University, Egypt.

Abdel Hadi, M. A., E. I. El-Shafeey, M. S. Tadros and M. H. Soliman (2005). Occurrence distribution and epidimics of white tip nematode (Aphelenchoidesbesseyi) on rice plants in Egypt. J. Agric. Sci. Mansoura Univ., 30 (2):1169-1182.

Abou El-Darag, I. H.; S. S. M. Abd El-Naby and A. M. A. El-Ghandor (2017). Effect of water regime and weed control treatments on weeds, growthand yields in hybrid rice.J. Plant Production, Mansoura Univ., 8(9): 939 – 943.

ABOULILA, A. A., and O. A. GALAL. (2019). “Evaluation of silica nanoparticles (SIO2NP) and somaclonal variation effects on genome template stability in rice using rapd and SSR markers.” Egyptian journal of genetics and cytology 48 (1): 1–16. https://doi.org/10. 1016/b978-0-12-782202-0.50007-2.

Bajavathiannan, M. V.; J. K. Norsuorthy and R. C. Scott (2011). Comparison of weed management programs for Furrow-Irrigated and flooded hybrid rice production in Arkansas. Weed Technology, 25(4): 556-562.

Chuanxu Li, Jianguo Zhang, ZhiyongRen, RongXie, Changxi Yin, Weihua Ma, Fei Zhou, Hao Chen, YongjunLina,b (2020). Development of "MultiResistance Rice" by Assembly of Herbicide, Insect and Disease resistance Genes with a Transgene Stacking System. In Pest management science. https://doi.org/10.1002/ps.6178.

Dar, Manzoor H., Showkat A. Waza, Sarvesh Shukla, Najam W. Zaidi, Swati Nayak, Mosharaf Hossain, Arvind Kumar, Abdelbagi M. Ismail, and Uma S. Singh. (2020). "Drought Tolerant Rice for Ensuring Food Security in Eastern India." Sustainability (Switzerland) 12 (6): 1–17. https://doi.org/10.3390/ su12062214.

Dubina, E.V., P.I. Kostylev., S.V. Garkusha., M.G. Ruban., (2020). Development of blast-resistant rice varieties based on application of DNA technologies. In Euphytica. 216:162. https://doi.org/10.1007/ s10681 020-02698-4

Elmoghazy, A. M., and M. M. Elshenawy. (2017). Sustainability of Agricultural Environment in Egypt: Sustainable Cultivation of Rice in Egypt.

El-Mowafi, H.F, A.O. Bastawisi, K.A. Attia, A.F. Abdelkhalik, R.M. Abdallah, A.M. Reda, E.F Arafat, *et al*. (2019). "EHR3 (Egyptian Hybrid Rice 3): A New High Yielding Hybrid Variety Ehr3 (Egyptian Hybrid Rice 3)." Egypt. J. Plant Breed. 23 (1): 11–23.

EL-Shafey, R.A.S. (2007). Biological and ecological studies on white tip nematode in rice with special reference to its control. Ph.D. Thesis, Fac. Agric., KafrELSheikh University.

EL-Wahsh, S.A. and S.A.A. Hammoud (2007). Evaluation of rice promising lines for blast resistance and some agronomic characters. J. Agric.Res., KafrELSheikh Univ., 33(1):140-157.

FAO, (2002). Sustainable rice production for food security. In Proceedings of the 20th session of the international rice commission. FAO, Bangkok, p. 23-26.

Gaballah, M. M., and A. A. Abd Allah. (2015). "Effect of Water Irrigation Shortage on Some Quantitative Characters at Different Rice Development Growth Stages." AWorld Rural Observations 16 (2): 39–55. https://doi.org/10.1377/ hlthaff.2013.0625.

Gaballah, M. M., and A. F. Abu El-Ezz (2019). "Genetic Behavior of Some Rice Genotypes under Normal and High Temperature Stress." Alexandria Science Exchange Journal 40 (2): 370–84. https://doi.org/ 10.21608/ asejaiqjsae. 2019.40780.

Gabr, W.S. (2004). Studies on rice blast disease in Egypt. M.Sc. Thesis, Fac. Agric., Tanta Univ., Egypt.

Gewaily, E. E., A. T. Mohammed, and W. T. Abd El-rahem (2019). "Effect of Different Irrigation Regimes on Productivity and Cooking Quality of Some Rice Varieties." World Journal of Agricultural Sciences 15 (5): 341–54. https://doi.org/ 10.5829/idosi.wjas.2019.341.354.

Gewaily, Saied (2019). "Influence of Arbuscular Mycorrhizal (AMF) Inoculation on the Performance of Sakha 107 Rice Cultivar under Different Irrigation Intervals." Environment, Biodiversity and Soil Security 3 (2019): 119–30. https://doi.org/10.21608/jenvbs.2019.15637. 1068.

Giudici, M.L., B. Villa, A.M. Collegarin and L. Tamborini (2003). White tip disease in Italian rice. Proceeding of the 3rd International Rice Conference, 10-13 March, Punta de L"Este, Uruguay.

Hammoud, S.A.A and W.S. Gabr (2014). Behavior of some rice genotypes as affected by some major diseases infection under different conditions. Plant Prot. And Path., Mansoura Univ., vol.5 (9): 871-890.

IRRI, (2016). Standard Evaluation System (SES) for Rice (IRRI) P.O. Box 933. 1099, Los Banios, Manila Philippines.

IRRI, (2002). Rice almanac. IRRI-WARDA-CIAT-FAO, Los Banos.

IRRI, (2002). Rice Almanac. 3rd edition. International Rice Research Institute, Los Baños, Philippines. 181.

Li, X.M.; L.Y. Ma; X.D. Zhu and C.D. Yang (2005). Study on sensitivity of different dwarf materials/lines to gibberellic acid and PP333. J. Fujian Agric. Forest. Univ. (Natural Science Edition), 34: 5-10.

Mackill, David J, and Gurdev S Khush (2018). "IR64 : A High-Quality and High-Yielding Mega Variety." Rice 11 (18): 11.

Mahmoud, M. (2015). Yield and water productivity of riceon raised beds, irrigation intervals and ammonia gas injection at North Nile Delta. J.Soil Sci. Agric. Eng., Mansoura Univ., 6, 1373–1387.

Ou, S.H. (1985). Rice Diseases (2nd). CMI, Kew, UK. Rood, M.A. (2004). Bakanae in field yield loss. Rice J., 15:8-10.

Ramadan, Ebrahim A., Galal B. Anis, Mohamed Gawish, and Mostafa M. Elshenawy (2017). "Fingerprinting of Some Egyptian Rice Genotypes Using Intron-Exon Splice Junctions (ISJ) Markers." J Plant Mol Breed 5 (2): 38–49. https://doi.org/10.22058/JPMB.2019.87092.1161.

RRTC, (2018). Rice Research and Training Center (National Rice Research Program): Final results of 2012 2017 growing season. Sakha, Kafrelsheikh, Egypt

Schiocchet, Moacir Antonio, Jose Alberto Noldin, Juliana Vieira Raimondi, Augusto Tulmann Neto, Rubens Marschalek, Ester Wickert, Gabriela Neves Martins, *et al*. (2014). "SCS118 Marques - New Rice Cultivar Obtained through Induced Mutation." Crop Breeding and Applied Biotechnology 14 (1): 68–70. https://doi.org/10.1590/S1984-70332014000100012.

Singh, S.; L. Bhushan; J. K. Ladha; R. K. Gupta; A. N. Rao and B. Sivaprasad (2006). Weed management in dry-seeded rice (Oryza sativa L) cultivated in the furrow-irrigated raised-bed transplanting system. Crop Protection, 25: 487–495.

Sorourl, F. A., T. F. Metwally, I. S. El-Degwy, E. M. Eleisawy, and A. A. Zidan (2020). "The Effects of Nano Phosphatic Fertilizer Application on the Productivity of Some Egyptian Rice Varieties (Oryza Sativa L.)." Applied Ecology and Environmental Research 18 (6): 7673–84. https://doi.org/10.15666/ aeer/1806_76737684.

Townsend, G.R. and J.W. Huberger (1943). Methods of estimating losses caused by diseases in fungicide experiments. Plant Dis.Reptr.27 (7): 340-343.

سخا 107 صنف أرز مصري عالي الانتاجية وجودة الحبوب وموفر للمياه ومتحمل لظروف نقص المياه

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[2] قسم بحوث أمراض الأرز – معهد بحوث أمراض النباتات – مركزالبحوث الزراعية – مصر
[3] مركز البحوث والتدريب والارز – معهد بحوث وقاية النبات – مركزالبحوث الزراعية – مصر

سجل صنف سخا 107 في عام 2016كصنف ارز مصري عالي الانتاجية و الجوده العالية لصفات الحبوب وكصنف متحمل لظروف نقص المياه , قصير الطول ومبكر النضج. استنبط صنف 107 من التهجين الفردي بين صنف جيزة177 مع الصنف بي ال1 . اجري التهجين عام 1999 ثم الجيل الاول والاجيال النعزالية من الجيل الثاني حتي الجيل الخامس حتي الوصول الي درجة الثبات والتجانس والنقاوة الوراثية في الجيل السادس عام 2006 .تميزةالسلاله جي زد 8710-3-2-1-1 عن كل السلالات المقيمة من 2007 الي 2016 في تجارب مقارنة المحصول الاولية والاقليمية والنهائية والتاكيديةو الارشادية. يتميز صنف 107 بالصفات المزرعية الممتازة مثل مجموج جزري قوي وقوة نمو للبادرات والقدرة العالية علي التفريع وقصر الساق والتبكير في النضج حوالي 123 يوم والاوراق القائمة ودليل مساحة الورقة العالي و عدد سنابل عالي و السنابل الكبيرة وشكل الحبة القصير ومحصول حبوب عالي حوالي 10.45 و 8.5 طن هكتار$^{-1}$ فى الحقول الأرشادية التى اقيمت فى بعض المحافظات خلال الفترة من 2017 حتى 2019 تحت ظروف الري الطبيعية وكذلك تحت ظروف نقص المياه ودليل حصاد عالي 44 % وكذلك صفات تبيض والكيميائية وصفات الطبخ الممتازة مع المقاومة للرقاد والامراض الرئيسية مثل اللفحة والتبقع والتفحم الكاذب والنيماتوده والبكانا بالاضافة احتوائه علي الجينات الوراثية للانتاجية العالية.لذلك تم تسجيل صنف سخا 107 وينصح بزراعه في الاماكن المتنوعة لزراعة الارز خصوصا في الاماكن التي تتعرض لنقص مياه ومصادر الري في مصر.