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Improvement System of Rice Intensification (Sri) For Some Rice Genotypes

Attia, A. N. E[1];A. T. El-kssaby[1]; A. E. Draz[2]and T. M. El-Hefnawy[2]
[1] **Agronomy Department, Faculty of Agricultural, Mansoura University.**
[2] **Rice Res. Section, Field Crop Res. Inst., ARC, Giza, Egypt.**

ABSTRACT

Field Experiment was carried out in summer seasons of 2014 and 2015 at the Experimental Farm of Rice Research Section, El-Gemmiza, Agricultural Research station, El-Gemmiza, Gharbia Governorate, Egypt. This fulfillment was conducted to study the response of three rice genotypes (Sakha 106, Giza 179 and Hybrid 3), two types of fertilization (chemical and compost fertilization), weeding control (hand weeding and chemical control) and plant density (one, two and three plants/hill) on yield and its attributes traits. Genotypes significantly differed in all studied traits. Hybrid 3 genotype produced the maximum values of No. of tillers and panicles/m², length of panicle , No. of total grains for panicle and 1000- grain weight as well as yield of grain/fed). While, the lowest values of these traits were recorded with Sakha 106 genotype. Chemical fertilization had significant effect on some of studied charactars. Weeding control treatments had non-significant effects on all studied characters, except No. of tillers/m² and length of panicle in the 1st season. Three plants/hill produced the highest values, while the lowest values of the previous traits were obtained when using one plant/hill. In general, it could be recommended that planting Hybrid 3 genotype as one plant/hill, Giza 179 genotype as two plants/hill and sakha 106 genotype as three plants/hill and organic fertilized with compost and using hand weeding under the new treatments of system of rice intensification.

Keywords: Chemical and compost fertilizer,No. of plants/ hill and SRI.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the important cereal crop in the world as well as in Egypt and the main food for more than half of the world people. The need to raise grain yield of rice per unit land area is considered anative goal to meet the consistent demande from this crop. Among various factors affecting rice production, such as cultivars, typs of fertilization , planting spacing between hills, No. of plants / hills, planting methods, and other most important agronomic practices.

High yielding ability cultivars are very serious to raise productivity. For this reason and some other several traits are aming to evaluate the new promsing cultivars with the old traditional for scoping light on the best cultivar that can be used on a large scale .Many investiglators revealed that rice cultivars significantly differed in grain yield and its attributing characters, as reported by El-Maksoud (2008) and Zaki *et al*. (2009).

Rice provid the bulk of food calories consumed by more than half of the world's population. Conventionally grown paddy rice requires a large volume of water and is highly labor intensive; the former is becoming increasingly scarce and the latter increasingly expensive (Saqib *et al*., 2012). Maintaining food security in Asia demands the elaboration of new rice production systems which reduce the crop's requirement for water and avoids the need to perform manual transplanting; one such system is direct planting into dry soil.

Paddy soil system favors fertility maintenance and build-up of organic matter in soils, and is the backbone of long-term sustainability of the wetland rice systems. The application of inorganic fertilizers is costly and gradually leads to the environmental problems.Thus, organic residue recycling is becoming an increasingly important aspect of environmentally sound sustainable agriculture.Nowadays, agricultural production based on organic applications is growing in interest and the demands for the resulting products are increasing. Therefore, the effective use of organic materials in rice farming is also likely to be promoted (Myint *et al*, 2010).

Direct planting requires only 34% of the total labour requirement of transplanted rice (Romli 2002) and 29% of the total cost of transplanted rice production without any yield loss. Drill planting, a variant of direct planting, is sowing the plants in rows at specified plant rate, depth, and covers those with soil under dry or moist condition.This method of rice establishment substantially reduces labour requirement, improves emergence of plants, and reduces lodging to less than 10% (Bakker *et al*., 2002).

The present investigation aimd to evaluate the effect of fertilization, weeding control treatments, and plant density of some rice genotypes and their interactions under the system of rice intensification (SRI) for yield and yield components under El-Gemmiza, Gharbia Governorate.

MATERIALS AND METHODS

Field experiment was conducted at the Farm of Rice Research Section, Agricultural Research Station, El-Gemmiza, Gharbia Governorate, in 2014 and 2015 seasons. The objective of this study was to evaluate the influence of fertilization, weeding control and No. of seeds/hill and their interactions on yield and its attributes of some rice genotypes under system of rice intensification (SRI).

Each rice genotype *i.e.* Sakha 106, Giza 179 and Hybrid 3 was performed in separate experiment. Every experiment of rice genotype was carried out in design of strip-split plot with three replications in both seasons. Rice seeds of the studied genotypes *i.e.* Sakha 106, Giza 179 and Hybrid 3 were obtained from Agricultural Cooperation Agricultural Research Station, El-Gemmiza, Gharbia Governorate.

The vertical-plots were occupied to fertilization treatments (chemical fertilization and compost). Calcium super phosphate (15.5 % P_2O_5) was added in the dry soil before ploughing (100 kg/fed). Nitrogen fertilizer in the form of urea (46 % N) was added at the rate of 60 N/fed in three portions, the first part was

added in the dry soil before ploughing, the second part was added after 30 days from planting, and the third part was added after 20 days from the second part. The compost was added at the rate of 2.5 t/fed in the dry soil before ploughing. Chemical analysis of compost used in both seasons is presented in Table 1.

Table 1. Chemical compost characteristics during the two growing seasons of 2014 and 2015.

Compost analysis	First season 2014	Second season 2015
pH	7.35	7.41
EC (ds m^{-2})	2.18	2.22
OC	8.8	8.7
OM (%)	15.17	15.01
N (%)	1.24	1.14
C / N	10.91	10.81
Bulk density (g/cm^3)	0.81	0.91
P (%)	0.65	0.75
Ca (%)	1.65	1.55
K (%)	0.91	0.81
Mg (%)	0.40	0.50
Na (%)	0.65	0.59

The horizontal-plots were occupied to weeding control treatments (chemical control and hand weeding). In chemical control treatment, weeds were controlled by using Saturn herbicide (50 %) at the rate of 2 L/fed after seven days after planting and Inpul (75% WG) at the rate of 20 g/fed + Nominee (2 % SL) at the rate of 800 cm^3/fed after 23 days from planting. While, in handing control treatment, weeds were handy controlled with laborers at twenty, forty and sixty days after planting.

The sub-plots were devoted to plant density (one, two and three plants/hill). Seeds of rice genotypes (Sakha 106, Giza 179 and Hybrid 3) were planted with dry seeds at the rate of 4-6 seeds/hill on dry land and then thinned after 10 days from emergence to studied No. of plants/hill (1, 2 or 3 plants/hill).

The experimental plot size was 3- m width and 3.5-m length, resulted an area of 10.5 m². The previous winter crop was Egyptian clover (*Trifolium alexandrinum*) in both seasons.

Soil samples were taken at a depth of 0 - 15 and 15 - 30 cm from soil surface before soil preparation during the growing seasons and mixed to make homogeneous sample to measure the mechanical and chemical soil properties and the corresponding data are presented in Table 2.

The experimental field was prepared as recommended. Seeds of rice genotypes (Sakha 106, Giza 179 and Hybrid 3) were planted with dry seed on dry land and then irrigation on 14th and 18th May in 2014 and 2015 seasons, respectively. The land was flushed with water. The spacing between hills and rows was 30 × 30 cm.

However, the common agricultural practices for growing rice according to the recommendations of Ministry of Agriculture and Land Reclamation were followed, except the factors under study. SRI watering management was followed (Irrigation was when the onset of cracking of the soil, or once a ten days).

At harvest, the following data were recorded: 1- No of tillers per m^2, No. of panicles per m^2, length of panicle , No. of total grains for panicle, 1000- grain weight and yield of rice grain (t/fed).

All data of this study were subjected to the statistical analyzed as used experimental design as mentioned by Gomez and Gomez (1984), by using means of "MSTAT-C" computer software package. LSD method was used to conmpare differences among means of treatment as described by Snedecor and Cochran (1980).

Table 2. Soil characteristics at the experimental site in 2014 and 2015 seasons.

Soil analysis		First season 2014	Second season 2015
A: Mechanical properties:			
Sand (%)		13.61	13.60
Silt (%)		24.87	24.89
Clay (%)		56.52	56.51
Texture		clay	clay
B: Chemical analysis			
Soil reaction pH		7.89	7.76
EC (ds m^{-2}) in soil water extraction (1:5) at 25^0C		5.61	5.60
Organic matter (%)		2.76	2.70
Total carbonate (%)		2.75	2.74
Available N (ppm)		85.2	86.3
Soluble cations meq/L	Ca^{++}	16.75	15.73
	Mg^{++}	12.31	13.00
	Na^{+}	26.25	25.23
	K^{+}	0.78	0.80
Soluble anions meq/L	CO_3^{--}	-	-
	HCO_3^{-}	7.81	7.75
	Cl^{-}	23.50	23.45
	SO_4^{--}	24.79	24.90

RESULTS AND DISCUSSION

Genotypes performance:

In both seasons the results in Table 2 indicated that the three tested genotypes significantly differed in most of studied characters. Hybrid 3 rice genotype were highly produced the highest No. of tillers /m², No. of panicles /m², length of panicle (cm) in the 1st season, No. of total grains / panicle in the 2nd season in the 1st season and grain yield (t/fed). While Sakha 106 rice genotype produced the lowest values accept 1000- grain weight (g) in the first and the second seasons produced the highest weight. Differential performance of two genotypes may be attributed to differences between genetic backgrounds. These results were parallel with those reported by Abou khalifa *et al* (2009).

Effect of Fertilization:

All the measured traits under study showed non-significant affects by fertilization except for grain yield (t/fed) which showed highly significant in the 1st season indicated in table 2. These outcomes are in conformity with those obtained by Karki (2006), Chhogyel *et al* (2015) and Metwally (2015).

Table 2. Means of No. of tillers /m², No. of panicles /m², length of panicle (cm), No. of total grains/ panicle, 1000- grain weight and grain yield(t/fed) of rice as affected by genotypes, Fertilization and No. of plants / hill during 2014 and 2015 seasons.

Characters	No. of tillers/ m²		No. of panicles /m²		Panicle length (cm)		No. of total grains/ panicle		1000- grain weight (g)		Grain yield (t/fed)	
Treatments	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
A- Rice genotypes:												
Sakha 106	233.849	272.814	219.400	305.084	20.113	22.796	146.902	146.210	28.184	28.251	3.056	2.893
Giza179	309.196	358.035	308.263	357.151	20.268	22.331	153.807	153.542	24.058	24.244	3.442	3.335
Hybrid 3	314.412	378.657	312.079	401.117	20.794	23.491	162.921	166.806	24.127	23.814	3.708	3.566
F. test	*	**	**	**	NS	**	*	NS	*	**	**	**
LSD at 5 %	57.89	12.33	21.5	17.84	-	0.55	10.26	-	2.84	1.05	0.11	0.11
B-Fertilization:												
chemical	314.133	334.287	309.830	333.555	20.981	22.799	161.186	155.899	25.235	25.028	3.473	3.198
compost	257.506	338.717	251.331	337.680	19.802	22.947	147.901	155.139	25.677	25.844	3.331	3.331
F. test	NS	NS	*	NS	**	NS	NS	NS	NS	NS	**	*
LSD at 5 %	-	-	54.4	-	0.63	-	-	-	-	-	0.06	0.1
C- weeding control:												
Chemical control	294.146	332.168	285.869	353.820	20.676	22.871	155.716	157.556	25.957	25.363	3.408	3.244
Hand weeding	277.493	340.836	275.292	366.415	20.107	22.875	153.371	153.482	24.955	25.509	3.396	3.285
F. test	*	NS	NS	NS	**	NS	NS	NS	NS	NS	NS	NS
LSD at 5 %	15.5	-	-	-	0.33	-	-	-	-	-	-	-
D-No. of plants / hill:												
One plant	301.739	311.917	300.619	310.074	20.392	24.364	156.947	152.945	24.932	25.639	3.302	3.144
Two plants	272.007	330.633	270.143	329.435	20.240	22.834	152.752	153.029	25.432	25.323	3.407	3.202
Three plants	283.712	366.955	270.979	365.844	20.542	21.420	153.932	160.584	26.004	25.348	3.497	3.447
F. test	**	**	**	**	NS	**	NS	NS	NS	NS	**	**
LSD at 5 %	19.06	26.25	18.8	17.84	-	0.3	-	-	-	-	0.05	0.1

Effect of weeding control treatments:

The data in table 2 showed non-significant affects weeding control except No. of tillers/m² and length of panicle (cm) in the 1st season. These results were parallel with those reported by Chauhan and Johnson (2010) and Antralina *et al.* (2015).

Effect of plant density:

The statistical analysis of data in Table 2, recorded that more of measured trait were highly significantly affected by No. of plants / hill, the highest No. of tillers /m² in the 1st season, No. of panicles /m² in the 1st season and length of panicle (cm) in the 2nd season, were produced when using the one plant. These results are in agreement with those obtained by Ho and Romli (2002).

Effect of the interaction between genotypes and fertilization:

The results in Table 3 indicated that the interaction between genotypes and fertilization had a significant effect on some measured traits. The highest length of panicle (cm) and grain yield (t/fed) were recorded when using Hybrid 3 genotype and compost fertilization and chemical fertilization respectively. While the lowest value of these traits were produced when using Giza179 and Sakha 106 genotype and chemical fertilization. El-Kassaby *et al* (1991), Salem *et al* (2011) and El Shamey (2016).

Table 3. Means of length of panicle (cm) and grain yield (t/fed) of rice as affected by the interaction between genotypes and Fertilization during 2015 season.

Characters		Length of panicle (cm)	Grain yield (t/fed)
Treatments		2015	
genotypes	Fertilization		
Sakha 106	chemical	23.432	2.645
	compost	23.432	3.141
Giza179	chemical	22.152	3.287
	compost	22.511	3.383
Hybrid 3	chemical	22.812	3.663
	compost	24.171	3.469
F. test		*	**
LSD at 5 %		1.49	0.18

Effect of the interaction between genotypes and weeding control:

The results in Table 4 indicated that the interaction between genotypes and weeding control on grain yield (t/fed) had a significant effect. The highest No. of grain yield (t/fed) in 2014th season were recorded when using Hybrid 3 and Chemical control. On the other hand, the lowest values of these traits were produced when using Sakha 106 and hand weeding.

Table 4. Means of grain yield of rice as affected by the interaction between genotypes and weeding control during 2014 season.

Characters / Treatments		Grain yield (t /fed) 2014
genotypes	Weeding control	
	Chemical	3.068
Sakha 106	control	
	Hand weeding	3.044
Giza179	Chemical control	3.406
	Hand weeding	3.479
Hybrid 3	Chemical control	3.751
	Hand weeding	3.665
F. test		*
LSD at 5 %		0.11

Effect of the interaction between fertilization, weeding control and No. of plants / hill:

The results in Table 5 indicated that the interaction between fertilization, weeding control and No. of plants /hill on measured trait differ significantly. The highest No. of tillers / m^2 and No. of panicles /m^2, were recorded when using chemical fertilization with hand weeding and one plant /hill in the 1st season. On the other hand, while the lowest values of these traits were obtained when using compost fertilization with hand weeding and two plants /hill. Shinde *et al* (2005).

Finally, for improving the productivity of rice crop under the conditions of the present study it is suggested that is to planted Hybrid 3 with compost fertilizer and one plant /hill and Giza 179 genotype with compost fertilizer and two plants /hill and sakha 106 with compost fertilizer and three plants /hill and using hand weeding under the new treatments of system of rice intensification.

Table 5. Means of grain yield (t/fed) of rice as affected by the interaction between genotypes, fertilization and No. of plants / hill during 2014 season.

Characters			No. of tillers /m2			No. of panicles /m2		
Treatments			2014					
No. of plants / hill Fertilization control		Weeding	One plant/hill	Two plants/hill	Three plants/hill	One plant/hill	Two plants/hill	Three plants/hill
chemical	Chemical control		304.539	322.213	342.436	293.471	304.516	335.997
	Hand weeding		350.064	286.959	278.587	345.434	299.947	279.614
compost	Chemical control		280.874	243.490	271.323	290.440	249.341	241.448
	Hand weeding		271.480	235.366	242.501	273.129	226.770	226.859
F. test				*			**	
LSD at 5 %				38.13			37.72	

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تحسين نظام التكثيف المحصولى لبعض التراكيب الوراثية للأرز

أحمد نادر السيد عطيه[١] ، عوض طه القصبى [١] ، عبد السلام عبيد دراز[٢] و تامر مصطفى الحفناوى[٢]

[١] قسم المحاصيل – كلية الزراعة – جامعة المنصورة – مصر.

[٢] مركز البحوث و التدريب في الأرز- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية - مصر.

أقيمت تجربة حقلية في محطة البحوث الزراعية بالجميزة خلال موسمى الزراعة ٢٠١٤ و٢٠١٥م وذلك لدراسة تأثيركلا من نوع التسميد ، مقاومة الحشائش وعدد الحبوب بالجورة على المحصول ومكوناته لبعض التراكيب الوراثية سخا ١٠٦، جيزة ١٧٩ و هجين ٣. تم تنفيذ التجربة في تصميم الشرائح المنشقة ، وضعت التراكيب الوراثية (سخا ١٠٦، جيزة ١٧٩ و هجين ٣) في القطع الرئيسية ونوع التسميد (تسميد كيماوى وكمبوست) في الشرائح الأفقية ومقاومة الحشائش (كيماوى و يدوى) فى الشرائح الرأسية و عدد الحبوب بالجورة (نبات واحد, نياتان وثلاث نياتات بالجورة) فى القطع المنشقة. وتشيرأهم النتائج المتحصل عليها إلى مايلى:إختلفت الأصناف فيما بينها فى تأثيرها على كلا من عدد الأفرع القاعدية / م٢, عدد السنابل/ م٢, طول السنبلة سم, عدد الحبوب الممتلئة بالسنبلة, وزن الألف حبة ومحصول الحبوب للفدان, وسجل التركيب الوراثى هجين٣ أعلى بعض هذه القيم بينما أعطى التركيب الوراثى سخا ١٠٦ أقلها فى بعضها واعطت أعلى انتاجية فى البعض الاخر. أثر نوع التسميد على كل الصفات المدروسة , فقد أعطى التسميد الكيماوى أعلى بعض القيم بينما أعطى التسميد بالكمبوست أقل إنتاجية فى بعض القيم وأعلاها فى البعض الأخر. أثرت عدد النباتات بالجورة تأثيرا معنويا على كل الصفات المدروسة, وأعطت الثلاثة نباتات أعلى إنتاجية فى بعض هذه القيم بينما كان أقلها إنتاجية فى بعضها عند إستخدام نبات واحد فى الجورة و أعلاها فى القيم الأخرى. أثر التفاعل بين عوامل الدراسة تأثيرا معنويا على معظم الصفات تحت الدراسة وكان أعلى هذه القيم عند إستخدام التركيب الوراثى الهجين ٣ وإضافة التسميد الكيماوى يلية الكمبوست وزراعة ثلاث نباتات بالجورة. بينما كان أقل هذه القيم عند إستخدام التركيب الوراثى سخا ١٠٦ والتسميد بالكمبوست وزراعة نبات واحد فى الجورة.من النتائج المتحصل عليها فى هذه الدراسة فإنه يمكن التوصية بإستخدام التراكيب الوراثية هجين٣ مع التسميد بالكمبوست و زراعة نبات واحد بالجوره و زراعة جيزة ١٧٩ باستخدام سماد الكمبوست وزراعة نباتان بالجورة و زراعة سخا ١٠٦ بالتسميد الكمبوست وزراعة ثلاث نباتات بالجورة ومقاومة الحشائش يدويا وذلك بإستخدام تحسينات نظام التكثيف المحصولى . وذلك للحصول على أعلى إنتاجية من محصول الأرز تحت ظروف منطقة محطة البحوث الزراعية بالجميزة – محافظة الغربية.