PRELIMINARY STUDIES ON HYBRID RICE SEED PRODUCTION TECHNOLOGY IN EGYPT

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Abstract

F_1 seed production experiments were conducted at RRTC Farm, Sakha, Kafr El-Sheikh, Egypt during 2001 and 2002 summer seasons for two promising hybrid rice combinations, viz., IR 69625 A/Giza 182 R and IR 58025 A/Giza 178 R. Different sowing dates of the male and female parents were applied to get the best flowering synchronization . Three row ratio, 2R:8A, 2R:10A and 2R:12A in two sowing seasons were applied for both hybrids in split plot design. A 200g dose of GA_3 was used and split in two sprays. First spray (80 g GA_3) was done when 15-20% of female tillers emerged. The balance of GA_3 (120 g/ha) was sprayed when 40% tillers emerged. The results revealed that the best flowering synchronization of the parents was achieved when IR 69625Awas sown 7-9 days earlier than Giza 182 R, and IR 58025 A 12 days earlier than Giza 178 R. The row ratio of 2R:10A gave the highest yield for both hybrids in two seasons. The average seed yield ranged from 2.85 to 3.19 tons/ha for the first hybrid and 2.80to 3.11 tons/ha for the second hybrid under these experiments

INTRODUCTION

In Egypt, the averaged national yield level of rice has to be increase by 25-30% to meet the demands of the increasing population. This seems difficult considering the narrow gap between yield potential and actual yield (9.4 t/ha in 2001 season). Among available technologies to increase yield above the present ceiling, is the exploitation of heterosis in hybrid rice which appears to be a practical approach for Egypt.

Egyptian scientists started hybrid rice research in 1987. However, goal oriented systematic research for breeding was initiated in 1995 (Bastawisi *et al.* 1998). Several promising hybrids were identified in 2000. Standard heterosis estimates for yield of promising hybrids are 15-20% for normal soil and 20-30% for saline soil. The present study was initiated for establishing F_1 seed production package for exploiting commercial hybrid rice varieties in Egypt. The most specific objectives for this study were: 1) to find the proper date of sowing for the male and female parents of elite hybrids to insure flowering synchronization in the seed production plots, 2) to Determine suitable row ratio of male and female parents to get higher F_1 seed yield in seed production plot. These basic data will be useful for hybrid seed production of the two mentioned hybrid varieties.

MATERIALS AND METHODS

Materials:

Two cytoplasmic male sterile (CMS) lines were used, viz. IR 69625 A and IR 58025 A with their restorers (R), Giza 182 R and Giza 178 R, respectively. Being female and male of two promising hybrids viz. Sk.2058 H (IR 69625 A/Giza 182 R) and Sk. 2025 H (IR 58025A/Giza 178 R) were used for this F_1 seed production. These experiments were conducted at Rice Research & Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt during 2001 and 2002 summer seasons.

Methods :

The F_1 seed production plot was located at the middle of the field where breeder seed of restorer was taking place. The row ratios of 2R:8A, 2R:10A and 2R:12A during two seasons were applied for different hybrids. The design for these experiments was split plot design with four replications in plot size 2 x 5 m in dimension was used, the main plots were occupied by the sowing seasons and the sub plots were occupied by row ratios. An amount of 15 kg of IR 69625 A and 15 kg of IR58025 A, as CMS Lines and 5 kg of Giza 182 R Line and 5 kg of Giza 178R Line (seed rate 20 kg/ha of the two parental lines) were soaked in fresh water for 24 hours, then, drained and incubated for 24 hours to hasten early germination. The pre-germinated seeds of parental lines were uniformly broadcasted in the nursery on different sowing dates as in Table No.1. All cultural practices up to harvesting were done as recommended. Seedlings having 6-7 leaves were uprooted and transplanted as 2 seedlings per hill for A lines and 2-3 seedlings per hill for R lines.. Distance between R rows was 20 cm and 20 cm between R and A rows. Plant spacing within A rows was 15 cm. Spacing between R plants in R rows was 15 cm and between A plants in A rows was 15 cm too. A working alley 30 cm wide was left before R rows, according to Kyu (2000).

Adjustment methods for flowering synchronization of parental lines at Sakha in 2001 and 2002 summer seasons were done, according to Viraktmath (1995) :

1- 2 % urea for flowering daily

2- 1 % Kh_2PO_4 + 8 GA_3/ha for flowering earliness

Method of GA_3 application :

A dose of 200 g GA_3/ha was used to increase panicle exsertion, split in two sprays (Hoan, 2000),First Spray : 80 g GA_3 was dissolved in a volume of 450 L water, and sprayed when 15-20% of tillers of A lines have emerged. Second spray : 120 g of GA_3 was dissolved in a volume of 450 L water, and sprayed after 2 days of the first spray or when 40% of tillers of A lines have emerged.

Table 1. Sowing dates for the parents of the Two Promising hybrid combinations

Entry	Sowing date		Transplanting date	
	2001	2002	2001	2002
IR 69625 A	May 5	May 1	June 5	June 1
GIZA 182R S_1	10	3	10	3
GIZA182R S_2	14	5	14	5
GIZA182R S_3	17	8	17	8
IR58025A	May 5	May 1	June 5	June 1
GIZA 178R S_1	10	8	10	8
GIZA 178R S_2	14	12	14	12
GIZA 178R S_3	17	17	17	17

RESULTS AND DISCUSSION

The available data, on duration from seeding to heading of IR 69625 A and IR 58025 A and their restorer lines Giza 182 R and Giza 178 R, showed wide variation. In fact, their duration from seeding to heading depend on the date of sowing. In case of early crop sowing, the duration of varieties is longer, while, in late crop sowing the duration of varieties is decrease. Therefore, to overcome this problem, the panicle initiation stage of their parents was identified as the best method for synchronization of flowering according to Viraktmath (1995). Because the F_1 seed production of these hybrids which obtained in this study it's the first time in Egypt. For the Sk.2058H, the female parent IR 69625 A was identified in stage No.5 of panicle development (panicle development from panicle initiation to flowering, contains 9 stages). While, the male parent, Giza 182 R was in stage No.3, during 2001 season. The observations indicated that female being early and male being late, after decrease the interval between A line and R line to five days in 2002 summer season, the observation indicated that, male parent being early and female parent being late one stage, but A line should be early one stage at least comparing with R line. After using various treatments, for get synchronization, the heading dates were recorded and duration from seeding to heading 10% of tillers were calculated and presented in (Table 2).The data showed that Giza 182 R was identified as most synchronized with its female, IR 69625 A, according to heading date for both parents. On the other hand, for the Sk.2025H, when female IR 58025 A was in stage No. 4, the male parent was in stage No.5 during 2001 season. These observations also indicated that female parent being late and male parent is early, the same observations were found in 2002 summer season, the

female parent was in stage No. 4, while, male parent was in stage No. 4, respectively. These results indicated that, Giza 178 R was highly affected by sowing date but IR 58025 A was little affected by sowing date. After using various treatments, for get synchronization, the duration from seeding to heading 10% tiller of IR 58025 A was 105 days compared to the duration of Giza 178 R was 96 days for the third sowing date as presented in Table (table 3).

Table 2. Result of adjustment methods for flowering synchronization of parental lines at Sakha in summer seasons 2001 and 2002 for IR 69625 A/Giza 182.

Parental lines	Seeding date	Transplanting date	Days affected by other factors	Effect of Treatment	Heading date	Duration seed to heading (day)
2001						
IR 69625 A	May 5	June 5	4 L	2% urea (3 times)	Aug 14	101
Giza 182 R S_1	10	10	2 E	8 g GA_3 + Kh_2PO_4 *	13	95
Giza 182 R S_2	14	14	3 E	8 g GA_3 + Kh_2PO_4	14	92
Giza 182 R S_3	17	17	3 E	8 g GA_3 + Kh_2PO_4	16	90
2002						
IR 69625 A	May 1	June 1	4 E	1 % Kh_2PO_4	Aug 5	94
Giza 182 R S_1	3	3	3 L	2 % Urea	6	93
Giza 182 R S_2	5	5	4 L	2 % Urea	9	94
Giza 182 R S_3	8	8	3 L	2 % Urea	12	93

These results concluded that, the best flowering synchronization of the parents was achieved when IR 69625 A was sown 7 days earlier than Giza182R and IR 58025 A 12 days earlier than Giza 178 R. As well as, sowing date should be from 1 to 15 May.

Table 3. Result of adjustment methods for flowering synchronization of parental lines at Sakha in summer seasons 2001 and 2002 for IR 58025 A/Giza 178

Parental lines	Seeding date	Transplanting date	Days affected by other factors	Effect of Treatment	Heading date	Duration seed to heading (day)
2001						
IR 58025 A	May 5	June 1	4E	8 g GA_3 + Kh_2PO_4	Aug 18	105
Giza 178 R S_1	10	10	4L	Urea 2% (3 times)	19	100
Giza 178 R S_2	14	14	3L	Urea 2% (3 times)	21	98
Giza 178 R S_3	17	17	5L	Urea 2% (3 times)	22	96
2002						
IR 58025 A	May 1	June 1	4E	1 % Kh_2PO_4	Aug 13	104
Giza 178 R S_1	8	8	3L	2 % Urea (3times)	15	98
Giza 178 R S_2	12	12	1L	2 % Urea(2 times)	17	96
Giza 178 R S_3	17	17	2L	2 % Urea (3 times)	20	97

Results in Tables (4 & 5) showed clearly, the effect of sowing season and different row ratios, as well as, their interaction on some yield components for two promising hybrids. However, the data indicated to highly significant of two seasons and row ratio as well as their interaction on all studied characters except panicle exsertion and 100-grain weight of two seasons for two promising hybrids. These data were consistence in both seasons of experimentation. Because the interaction between the sowing season and row ratio is not significant. These results referred to the weather condition in Egypt is constant and suitable for hybrid seed production. Xu and Li (1998) in China mentioned that, conditions favorable for good out-crossing in rice have identified as: a daily temperature of 24-28 °C, a relative humidity of 70-80%, a diurnal difference in temperature of 8-10 °C and sunny days with a breeze.

Results of yield components of F_1 seed yields of the two hybrids are presented in Tables (4 & 5). These data showed wide differences in most characters between two promising hybrids especially seed set %, and grain yield, where the hybrid IR 69625 A/Giza 182 R gave the highest value of seed set % and grain yield because this hybrid was more synchronized and IR 69625 A is more purified and stable under Egyptian condition. The highest values of grain yield for the two hybrids referred to using a high dose of GA_3 and supplementary pollination which was done by two sticks three times every day during heading period. In Vietnam, Hoan (2000) showed that the actual yield increased from 1.68 tons/hin1996 to 2.782 tons/ ha. In 2002 season.

Results of yield for different row ratios in F_1 seed production of two promising hybrids are presented in tables (4 & 5) under two years. The row ratios 2R:10A (2 row of male to 10 row of female) gave the highest yields, comparing to row ratios 2R:8A and 2R:12A. From the results of these experiments, recommend that for get highest values of F_1 hybrid seed of hybrid IR 69625 A/Giza 182 R., should be sown the female IR 69625 A, 7 days before Giza 182 R after get good flowering synchronization which reflected the increase seed set % , while For the hybrid IR 58025 A/Giza 178 R for good flowering synchronization of its parents, the seeds of female IR 58025 A should be sown 12 days before sowing seeds of male Giza 178 which, increase seed yield/ha. .

The row ratios 2R: 10A (2 row of male to 10 row of female) was identified as suitable row ratios for seed production of both promising hybrids in two seasons. The ratio R:A should be further studied in combination with special of R as well as spacing of A lines in seed production plots in next crop season.

Table 4. Effect of sowing season and row ratio as well as their interaction on some yield components for IR 69625 A/Giza 182 R promising hybrid

Main effects and their interaction	Panicle exsertion (%)	Panicle weight (g)	Seed set (%)	100-grain weight (g)	Grain yield (t/ha)
A- Seasons (S) :					
2001	64.39 a	2.83 a	42.3 a	2.34 a	3.19 a
2002	63.25 a	2.47 b	39.1 b	2.29 a	2.85 b
F. test	n.s.	*	*	n.s.	*
B- Row ratio (R) :					
2:8	67.70 a	2.93 a	45.10 a	2.22 b	2.89 b
2:10	64.70 a	2.65 b	41.70 b	2.30 b	3.66 a
2:12	59.03 b	2.17 c	35.20 c	2.43 a	2.53 c
F. test	**	**	**	**	**
C- Interaction (F. test only):					
S x R	n.s.	n.s	n.s.	n.s.	n.s.

n.s. : Not significant * : Significant at 5% ** : Significant at 1%

Means followed by common letter are not significantly different in the 5% level by DMRT

Table 5. Effect of sowing season and row ratio as well as their interaction on some yield components for IR 58025 A/Giza 178 R promising hybrid

Main effects and their interaction	Panicle exsertion (%)	Panicle weight (g)	Seed set (%)	100-grain weight (g)	Grain yield (t/ha)
A- Seasons (S) :					
2001	66.85 a	3.27 a	39.50 a	2.42 a	3.11 a
2002	65.45 a	2.94 b	37.98 b	2.39 a	2.80 b
F. test	n.s.	*	*	n.s.	*
B- Row ratio (R) :					
2:8	68.33 a	3.60a	43.69 a	2.25 c	2.80 b
2:10	66.86 b	3.27 b	39.59 b	2.38 b	3.38 a
2:12	63.27 c	2.60 c	32.98 c	2.58 a	2.53 c
F. test	**	**	**	**	**
C- Interaction (F. test only):					
S x R	n.s.	n.s	n.s.	n.s.	n.s.

n.s. : Not significant * : Significant at 5% ** : Significant at 1%

Means followed by common letter are not significantly different in the 5% level by DMRT

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دراسات أولية على تكنولوجيا إنتاج تقاوى الأرز الهجين فى مصر

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أجريت تجارب إنتاج تقاوى الأرز الهجين فى مزرعة مركز البحوث والتدريب فى الأرز – سخا – كفر الشيخ – مصر فى الموسم الصيفى لعامى ٢٠٠١ و٢٠٠٢ لإثنين من الهُجن المبشرة وهما : IR 69625 A (سلالة عقيمة) × Giza 182 R (سلالة معيدة للخصوبة) وكذلك IR 58025 A (سلالة عقيمة) × Giza 178 R (سلالة معيدة للخصوبة) وأستخدم فى هذة الدراسة مواعيد مختلفة لزراعة السلالات العقيمة (A) مع السلالة المعيدة للخصوبة (R) حتى يمكن الحصول على أفضل توافق زهرى بينعما للحصول على أعلى محصول . كما استخدم أيضا ثلاث معدلات شتل لعدد السطوربين الاب (R) والام(A) وهى : ٢ سطر أب مع ٨ سطور أم ، ٢ سطر أب مع ١٠ سطور أم ، ٢ سطر أب مع ١٢ سطر أم . وتم رش حمض الجبريللين (٢٠٠ جرام/هكتار) على مرتين : الأولى (٨٠ جرام/هكتار) عند ١٥–٢٠ % تزهير، والثانية (١٢٠ جرام/هكتار) عند ٤٠% تزهير وذلك لتشجيع تبكير طرد السنابل وسهولة خروج السنبلة من الغمد لزيادة نسبة التلقيح .

وقد أظهرت النتائج أنه يمكن الحصول على أفضل توافق زهرى بزراعة السلالة العقيمة IR 69625 A من ٧–٩ أيام قبل السلالة المعيدة للخصوبة Giza 182 R . وبالنسبة للسلالة العقيمة IR 58025 A تزرع ١٢ يوماً قبل السلالة المعيدة للخصوبة Giza 178 R فى النصف الأول من شهر مايو. كما أن معدل الشتل ٢ سطر أب مع ١٠ سطور أم أعطى أعلى قيم محصولية لكلا الهجينين فى موسمى الزراعة ، وكان متوسط محصول التقاوى الهجين يتراوح من ٢,٨٥ – ٣,١٩ طن/هكتار للهجين الأول و ٢,٨٠ – ٣,١١ طن/هكتار للهجين الثانى تحت ظروف هذة الدراسة .