HYBRID RICE AS AFFECTED BY TRANSPLANTING SPACINGS AND NITROGEN FERTILIZATION LEVES

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ABSTRACT

Two-year field experiments were carried out during 2002 and 2003 summer seasons at the Experimental Farm, Kafr El-Sheikh, Faculty of Agriculture, Tanta University, aiming to find the optimum level of nitrogen and transplanting spacing for the four medium grain rice hybrids, HR1 (IR64608A × IR35366-62-1-2-2-3R), (IR64608A × Suweon 287R), HR3 (IR68884A × Suweon 287R) and HR4 (IR67701A × IR35366-62-1-2-2-3R), compared with the two pure line rice genotypes, Sakha 104 cultivar and IR64608B pure line. Three N levels; i.e., 25, 50 and 75 kg/fed. and three transplanting spacing distances; namely, 15 × 20, 20× 20 and 20 × 25 cm. were applied. A split-split plot design, with three replications was used. Nitrogen levels were allocated to the main plots and hill spacings were arranged in the sub-plots; while the genotypes occupied the sub-sub plots. The most important findings of this study could be summarized as follows :

Highly significant differences were detected among the rice genotypes in all studied traits. HR2 recorded the highest grain yield (t/fed.), 1000-grain weight, number of filled grains/panicle, panicle length, number of spikelets/panicle and flag leaf area (cm^2).

Application of nitrogen up to 50 kg/fed. significantly increased grain yield, number of field grains/panicle, number of panicles/plant and number of spikelets/panicle. The highest level of nitrogen (75 kg N/fed.) significantly increased, number of panicles/plant, sterility percentage, panicle length, flag leaf area, number of tillers/plant, number of days to 50% heading and plant height.

The transplanting distance of 20 × 25 cm gave the highest value for 50% heading, flag leaf area (cm^2), number of tillers per plant, panicle length (cm) and sterility percentage. While, the highest values for 1000-grain weight and grain yield (t/fed.) were detected under 15 × 20 cm.

The highest grain yield was recorded when HR2 was transplanted at 15 × 20 cm spacing and fertilized with 75 kg N/fed.

INTRODUCTION

China has shown 20-30% higher grain yield potential for rice hybrids in large scale production plots, with wider adaptability than conventionally bred varieties. The highest hybrid rice grain yield, obtained in China, was 12.8 t/ha, where the highest conventional grain yield was 10.0 t/ha (Virmani *et al*., 1981) and, recently, the japonica super hybrids, Diyan Type at Yunnan Province, yielded around 16 tons/ha (El-Keredy, 1999). Hybrid rice was released in 1976 to farmers. The acreage of hybrid rice was rapidly increased each year (El-Keredy, 1993). Therefore, adequate fartilization, at right time in proper manner, is essential to achieve potential grain yield of rice hybrids. Keeping these points in view, the present investigation was undertaken. Grain yield is a function of the number of panicles and grains/panicle and grain weight (Surekha *et al*., 1999). It is possible to get higher grain yield from these hybrids by applying optimum dose of nitrogen. Thus, there is a need to work out the optimum N requirement of the promising hybrids vis-à-vis conventional varieties to find out the extent of possible yield improvement by adopting these hybrids (Rao and Moorthy, 2002). Hybrid rice is highly responsive to fertilizers, but information on hybrid rice nutrition is negligible (Meena *et al*., 2003). The genetic potential of any variety cannot be fully explored without proper agronomic management practices. A suitable agro-technique is required, particularly, for different newly released or pre-released varieties for exploiting their genetic potential to produce maximum grain yield. Plant spacing of wetland bunded rice crop is an important factor to exploit the potential of the high yielding improved variety (Paraye *et al*. 1996). In addition, N fertilization and suitable genotype are the important factors for successful production of rice (Bali *et al*., 1995). Therefore, this study was conducted to find out the optimum transplanting spacing and N fertilizer levels to obtain the maximum grain yield from obtained hybrid rice varieties under transplanted conditions of Kafr El-Sheikh Governorate, Egypt.

MATERIALS AND METHODS

This investigation was carried out at the Experimental Farm, Faculty of Agriculture, Kafr El-Sheikh, Tanta University, during 2002 and 2003 summer seasons to study the effect of hill spacings (20 × 15, 20 × 20 and 20 × 25 cm) and nitrogen fertilizer levels (25, 50 and 75 kg N/fed.) on grain yield and its attributing variables of the medium grain hybrids; i.e., IR64608A × IR 35366-62-1-2-2-3R, IR64608A × Suweon 287R, IR68884A × Suweon 287R and IR67701A × IR35366-62-1-2-2-3R (El-Keredy *et al*. 2001), Sakha 104 medium grain cultivar,

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recommended by RRTC, Sakha, Egypt, and a selected high grain yield maintainer by the authors IR64608B from materials introduced from IRRI. Seeds of the four hybrids were obtained by the three line method during 2001 and 2002 summer seasons.

A split-split-plot design, with three replications, was used. The nitrogen fertilizer levels were allocated to the main plots, hill spacings were arranged in the sub-plots and the genotypes occupied the sub-sub-plots. The six genotypes were sown in nursery (plastic trays, 60 × 30 × 3 cm on May 1st of 2002 and May 2nd of 2003. The seedlings were transplanted on June 1st in both seasons. Each sub-sub-plot consisted of ten rows. The rows were 3 m long, 20 cm apart and one-seedling was transplanted per hill. Number of hills were 33.3, 25.0 and 20.0 m^2 for 20 × 15, 20 × 20 and 20 × 25 cm spacings among hills, respectively. Soil chemical analysis of the experimental field area over both seasons, revealed that EC = 7.25 ds/m^2, pH = 7.97, cations (meq/L) were as the follows : Na = 40, $(Ca + Mg)^{++}$ = 21 and K^+ = 1.7 and the anions were as follows: Co^- = 5.5, $C1^-$ = 24 and SO_4^{--}= 20 meq/L. The preceding crop was clover in both seasons. Nitrogen, in the form of Urea (46% N) was applied for each N level in two equal doses; i.e., ½ N at land preparation and the other half at panicle initiation. The other usual cultural practices of rice transplanting were conducted as recommended by the Ministry of Agriculture and land Reclamation, Egypt.

Studied characters :

Fifty percent heading date (days), flag leaf area (cm^2), according to Yoshida *et al.* 1976, plant height (cm), number of tillers/plant, panicle length (cm), number of panicles/plant, number of filled grains/panicle, 1000-grain weight (g), sterility percentage (%), grain yield (g/m^2) and grain yield (t/fed.).

Plants in the inner three square meters of each sub-sub-plot were harvested, collected together, labeled and tied. Plants were transported in the threshing floor for air drying for five days. Then, after the plants were threshed, the grains were separated. The grain yield was recorded in g/m^2 and, then, grain yield was converted to record grain yield in tons/fed. (one feddan = 4200 m^2).

Data were subjected to statistical analysis of variance as the usual technique (ANOVA) of the split-split plot design. The treatment means were compared, using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Comparison between obtained promising three line hybrids and conventional pure lines in studied characters :

The differences among genotypes, spacings, nitrogen fertilization rates and most their interactions were highly significant (Tables 1 and 2). In both seasons IR68884A × Suweon 287R was the significantly earliest in heading date. While, the latest one was IR64608B pure line. These differences among rice genotypes were mainly due to genetic factors. IR64608A × Suweon 287R recorded the maximum flag leaf area (cm^2) in the two seasons. While, the minimum leaf area was obtained by Sakha 104. The differences among rice genotypes for flag leaf area might be ascribed to the nature of the cultivars, which is mainly affected by the genetical and partially by environmental factors. A similar trend was found by Assey *et al.* (1992) and El-Keredy *et al.* (2003). IR68884A × Suweon 287R gave the tallest plant height, whereas IR64608A × IR35366-62-1-2-2-3R (R19) produced the shortest one in both seasons. Similar trend was obtained by Assey *et al.* (1992), El-Wehishy and Abdel-Hafez (1997) and El-Keredy *et al.*, (2003). The rice hybrid, IR64608A × IR35366-62-1-2-23R gave the highest number of tillers/plant, while the lowest one was recorded by IR64608B (in 2002). Such differences might be due to the while genetic of such hybrids background. These results were in agreement with those obtained by Abd El-Wahab (1998). IR64608A × Suweon 287R gave the longest panicles, while the shortest panicles were recorded by Sakha 104. Similar results were obtained by Gnady (1996), El-Wehishy and El-Keredy (1997), Singh and Singh (2000) and El-Keredy *et al.* (2003). IR64608A × Suweon 287R produced the highest number of filled grains/panicle, while, the lowest one was recorded by Sakha 104. These results were in general agreement with those obtained by Bhowmick and Nayak (2000), Maiti *et al.* (2003) and El-Keredy *et al.* (2003). IR64608A × Suweon 287R rice hybrid gave the heaviest 1000-grain weight, while IR64608A × IR35366-62-1-2-2-3R gave the lowest one. The highest value of sterility percentage was recorded by IR67701A × IR35366-62-1-2-2-3R. Whereas, the lowest one was recorded by Sakha 104. These results were in agreement with those reported by El-Keredy *et al.* (2003). IR64608A × Suweon 287R gave the highest value of grain yield (4.57 and 4.66 t/fed in 2002 and 2003, respectively). Increased grain yields could be attributed to the increase of filled grains and 1000-grain weight (Peng *et al.*, 1996). While, the lowest grain yield was obtained by the check genotypes (Table 2). Grain yield of IR64608A × Suweon 287R was up to 21.13 and 21.61% over the conventional cultivar, Sakha 104, and the selected high yield maintainer, IR64608B, respectively, and up to 3.47, 9.88 and 18.48%, over the IR64608A × IR35366-62-1-2-2-3R, IR68884A × Suweon 287R and IR67701A × IR35366-62-1-2-2-3R, respectively.

Spacing effects :

Fifty percent heading date, flag leaf area (cm^2), number of panicles/plant, panicle length (cm) and sterility percentage (%) were increased highly significantly increased by wider spacings. While, grain yield and its attributes, such as number of filled grains/panicle were highly significantly increased with narrow spacing (Tables 1 and 2). Closer spacing of 15 × 20 cm recorded significantly lower number of grains/panicle than the other two wider spacings.

Table (1): Means of some growth characters in 2002 and 2003 seasons as affected by genotypes, spacings, nitrogen levels and their interactions.

	Variable	No. of days to 50% heading		Plant height (cm)		Flag leaf area (cm^2)		Number of tillers/plant		Panicle length (cm)	
		2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Nitrogen levels (N)	25 kg N/fed.	107.57c	105.61c	104.78c	103.40c	38.04c	37.25c	14.62c	15.13c	26.10c	25.79c
	50 kg N/fed.	109.94b	107.78b	110.22b	109.33b	42.59b	41.27b	17.04b	17.42b	27.22b	27.14b
	75 kg N/fed.	112.19a	110.04a	113.17a	112.98a	46.94a	45.04a	18.73a	19.42a	27.68a	27.49a
	F. test	**	**	**	**	**	**	**	**	**	**
Spacings (s)	15 × 20 cm	108.15c	105.67c	110.34a	108.51b	40.31c	39.12c	14.29c	14.89c	26.50c	26.27c
	20 × 20 cm	110.0b	108.08b	109.06b	108.81a	42.79b	41.47b	16.98b	17.69b	27.15b	26.94b
	20 × 25 cm	111.54a	109.69a	108.78b	108.34b	44.65a	43.33a	19.12a	19.04a	27.33a	27.21a
	F. test	**	**	*	*	**	**	**	**	**	**
Genotypes (G)	IR64608A × R19	107.63d	103.63e	89.00f	91.21f	43.88b	41.31b	21.41a	20.19a	27.60c	27.88b
	IR64608A × R5	111.56b	108.48c	108.06c	106.5c	51.83a	49.52a	17.23b	15.56d	28.90a	29.92a
	IR68884A × R5	104.04e	103.37c	135.60a	132.01b	41.72d	40.70c	15.12e	16.42c	28.27b	27.15d
	IR67701A × R19	111.07b	110.22b	125.57b	122.01b	40.64c	40.92c	15.65d	19.49b	27.00e	27.58c
	Sakha 104	110.00c	107.89d	97.66e	99.02e	34.22f	35.27e	16.44c	15.33d	22.70f	21.97f
	IR64608B	115.11a	113.26a	100.42d	100.22d	42.86c	40.12d	14.92e	16.24c	27.39d	26.64e
	F. test	**	**	**	**	**	**	**	**	**	**
Interactions	N × S	ns	ns	ns	*	ns	**	ns	ns	**	**
	N × G	**	**	**	**	**	**	**	**	**	**
	S × G	**	**	**	**	**	**	**	**	**	**
	N × S × G	*	ns	**	**	**	**	**	**	**	**

R5: Suweon 287R. R19: IR35366-62-1-2-2-3R

Means followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

*, ** = significant at 5% and 1% levels of significance.

ns = not significant.

Significantly higher grain yield was recorded with 15 × 20 cm spacing than the other two wider spacings (Table 2). The higher grain yield with closer spacing was obtained (4.35 and 4.36 t/fed., respectively) owing to more number of panicles per unit area and 1000-grain weight. Similar results were, also, reported by Angiras and Sharma (1998), Siddiqui *et al.* (1999), Chopra and chopra (2000), Patra and Nayak (2001) and Balasubramanian (2002).

Table (2): Means of grain yield and its related characters in 2002 and 2003 seasons as affected by genotypes, spacings, nitrogen levels and their interactions.

	Variable	No. of panicles/plant		No. of filled grains/panicle		1000-grain weight (g)		Sterility percentage (%)		Grain yield (t/fed.)	
		2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Nitrogen levels (N)	25 kg N/fed.	13.43c	14.36c	171.4c	163.8c	26.60a	26.48a	15.61c	16.24c	3.7c	3.66c
	50 kg N/fed.	15.59b	16.24b	183.2a	177.6a	26.63a	26.04b	17.46b	17.84b	4.36a	4.42a
	75 kg N/fed.	17.41a	17.91a	174.3b	168.7b	26.27b	26.09b	19.82a	19.67a	4.31b	4.31b
	F. test	**	**	**	**	**	**	**	**	**	**
Spacings (s)	15 × 20 cm	13.21c	10.07c	172.7c	166.8c	27.01a	26.74a	16.06c	16.27c	4.35a	4.36a
	20 × 20 cm	15.72b	16.65b	179.5a	172.6a	26.48b	26.14b	17.67b	18.04b	4.21b	4.23b
	20 × 25 cm	17.49a	17.79a	176.7b	170.7b	26.01c	25.73c	19.15a	19.49a	3.83c	3.81c
	F. test	**	**	**	**	**	**	**	**	**	**
Genotypes (G)	IR64608A × R19	17.59a	17.72b	181.00b	173.8b	32.66f	23.47f	19.29d	19.37d	4.47b	4.45b
	IR64608A × R5	16.42b	14.90e	193.01a	186.6a	28.22b	28.82a	20.69b	20.80b	4.57a	4.66a
	IR68884A × R5	14.54d	16.08c	192.70a	186.0a	27.24c	26.17c	19.78c	19.96c	4.28c	4.12c
	IR67701A × R19	14.94d	18.67a	161.70d	152.6d	25.72c	25.09e	23.19a	24.54a	3.85d	3.94d
	Sakha 104	15.43c	14.26f	157.80d	153.2d	25.88d	25.89d	8.99f	9.79f	3.75e	3.87e
	IR64608B	13.93e	15.40d	171.50c	168.0c	28.29a	27.39b	13.84a	13.04e	3.83d	3.76f
	F. test	**	**	**	**	**	**	**	**	**	**
Interactions	N × S	**	ns	**	**	**	**	**	**	**	**
	N × G	**	**	**	**	**	**	**	**	**	**
	S × G	*	**	**	**	**	**	**	**	**	**
	N × S × G	*	**	**	**	**	**	**	**	**	**

R5: Suweon 287R. R19: IR35366-62-1-2-2-3R

Means followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

*, ** = significant at 5% and 1% levels of significance.

ns = not significant.

Effect of nitrogen levels :

Application of the high N dose (75 kg /fed.) delayed the 50% heading date, gave the tallest plants, produced the maximum flag leaf area, number of tillers or panicles/plant, panicle length, and the maximum sterility percentage (%). Adding the low dose (25 kg/fed.) resulted in the minimum number of days to heading, shortest plants or panicle length, minimum value of flag leaf area, the minimum number of tillers or panicles/plant, the lowest number of grains/panicle, the lowest sterility percentage (%) and the minimum rice grain yield (t/fed.). At the lowest nitrogen dose 25 kg/fed.), the heaviest 1000-grain weight was recorded. While the number of filled grains/panicle and rice grain yield recorded the highest value at 50 kg N/fed. These results were in general harmony with those obtained by El-Kalla *et al.* (1990), El-Wehishy and El-Keredy (1997), Zheng *et al.* (2001), Balasubramanian (2002), Tang *et al.* (2003), Meena *et al.* (2003) and Maiti *et al.* (2003).

Interaction effects :

Interaction between genotypes and plant spacings : Interaction effect between rice genotypes and plant spacings was highly significant for grain yield (Table 2). The highest rice grain yield (4.83 t/fed.) was obtained when IR64608A × Suweon 287R planted at spacing 20 × 15 cm, while the lowest one was found by Sakha 104 and IR64608B when transplanted at spacing 20 × 25 cm (Table 3).

Table (3): Effect of the interaction between genotypes and spacings on rice grain yield (tons/fed.).

Rice genotypes	Plant spacings (cm)		
	20 × 15	20 × 20	20 × 25
IR64608A × IR35366-62-1-2-2-3R	4.56 d	4.60 c	4.21 h
IR64608A × Suweon 287R	4.83 a	4.71 b	4.30 f
IR68884A × Suweon 287R	4.46 e	4.24 g	3.90 l
IR67701A × IR35366-62-1-2-23R	4.15 i	4.13 i	3.41 p
Sakha 104 cultivar	4.09 j	3.79 n	3.55 o
Selected high yield maintainer (IR64608B)	4.02 k	3.83 m	3.53 o

Mean designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

<u>Effect of interaction between plant spacing and nitrogen levels:</u> Interaction between plant spacing and nitrogen level was highly significant for grain yield (Table 2). The highest rice grain yield (4.62 t/fed.) was found between the combination of 20 × 15 cm plant spacing and 50 kg N/fed. (Table 4). While, the lowest one (3.39 t/fed.) was recorded when rice plants were transplanted at 20 × 25 cm spacing and fertilized with 25 kg N/fed.

Table (4): Effect of the interaction between genotypes and spacings on rice grain yield (tons/fed.).

Rice spacing (cm)	Nitrogen levels (kg/fed.)		
	25	50	75
20 × 15	3.87 f	4.62 a	4.57 b
20 × 20	3.79 g	4.44 c	4.42 c
20 × 25	3.39 h	4.12 d	3.95 e

Mean designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

<u>Interaction between genotypes and nitrogen levels :</u> Interaction effect between rice genotypes and plant sppacings was highly significant for grain yield (Table 2). When IR64608A × Suweon 287R rice genotype was fertilized with 75 kg/fed., the highest rice yield (4.93 t/fed.) was obtained (Table 5). While, the lowest one was recorded by IR67701A × IR35366-62-1-2-2-3R (3.42 t/fed.) or Sakha 104 (3.43 t/fed.), fertilized with 25 kg N/fed.

Table (5): Effect of the interaction between genotypes and nitrogen levels on rice grain yield (tons/fed.).

Rice genotypes	Nitrogen levels (kg/fed.)		
	25	50	75
IR64608A × IR35366-62-1-2-2-3R	3.95 j	4.71 c	4.71 c
IR64608A × Suweon 287R	4.13 g	4.79 b	4.93 a
IR68884A × Suweon 287R	3.70 l	4.47 d	4.43 e
IR67701A × IR35366-62-1-2-2-3R	3.42 n	4.26 f	4.01 i
Sakha 104 cultivar	3.43 n	4.04 i	3.97 j
Selected high yield maintainer (IR64608B)	3.46 m	4.08 h	3.83 k

Mean designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

Data in Table (6) showed that the rice hybrid, IR64608A × Suweon 287R, outyielded Sakha 104 rice cultivar by 28.84 and 31.13%, when transplanted at 15 × 20 and 20 × 20 cm spacings, respectively, associated with the highest nitrogen level (75 kg/fed.). While, such increases were about 26.85 and 33.47% over the pure line, IR64608B, under the over-mentioned plant spacings and nitrogen level. On the other hand, IR64608A × UR35366-62-1-2-2-3R was increased by about 34% over IR64608B under the highest nitrogen level and the wider plant spacing (20 × 25 cm). Also, IR64608A × Suweon 287R outyielded Sakha 104 rice cultivar by 28.57% when transplanted at 20 × 25 cm and fertilized with 50 kg N/fed.

Investigations are continued with the previous plant materials under studied treatments on milling and other quality characters.

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Table (6): Increasing percentage in grain yield of hybrids over Sakha 104 and IR64608B as check cultivars and lines as affected by nitrogen levels and plant spacings.

Plant spacings (cm)	Hybrids	Check	Nitrogen levels (kg/fed.) 25	50	75
15 × 20	IR64608A × IR35366-62-1-2-2-3R	Sakha 104	9.98	7.52	17.16
		IR64608B	13.24	12.69	14.54
	IR64608A × Suweon 287R	Sakha 104	21.34	5.31	28.84
		IR64608B	24.95	10.37	26.85
	IR68884A × Suweon 287R	Sakha 104	4.52	10.34	11.35
		IR64608B	7.62	15.64	8.86
	IR67701A × IR35366-62-1-2-2-3R	Sakha 104	- 8.9	7.46	4.59
		IR64608B	- 6.2	12.63	2.25
20 × 20	IR64608A × IR35366-62-1-2-2-3R	Sakha 104	22.83	21.47	20.27
		IR64608B	21.1	17.42	22.42
	IR64608A × Suweon 287R	Sakha 104	16.93	24.0	31.13
		IR64608B	15.29	19.87	33.47
	IR68884A × Suweon 287R	Sakha 104	12.96	9.94	13.0
		IR64608B	11.37	6.27	15.02
	IR67701A × IR35366-62-1-2-2-3R	Sakha 104	11.69	6.56	9.04
		IR64608B	10.11	3.6	10.98
20 × 25	IR64608A × IR35366-62-1-2-2-3R	Sakha 104	13.48	22.38	18.86
		IR64608B	7.56	15.88	33.93
	IR64608A × Suweon 287R	Sakha 104	23.45	28.57	11.78
		IR64608B	17.01	21.75	26.05
	IR68884A × Suweon 287R	Sakha 104	7.17	11.63	10.45
		IR64608B	1.58	5.7	24.45
	IR67701A × IR35366-62-1-2-2-3R	Sakha 104	- 2.72	2.09	-10.87
		IR64608B	- 7.79	-3.33	0.43

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الملخص العربى

تأثر الأرز الهجين بمسافات الشتل ومستويات التسميد الأزوتى

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كلية الزراعة بكفرالشيخ رقم بريد ٣٣٥١٦

ومعهد بحوث الأرز – جامعة يونان الزراعية – كومنج – الصين

أجريت تجربتان حقليتان خلال موسمى ٢٠٠٢ و ٢٠٠٣ بمزرعة كلية الزراعة بكفرالشيخ. تهدف الدراسة الى معرفة المستوى المناسب من التسميد الأزوتى وكذلك المسافة المناسبة للشتل لأربعة هجن من الأرز وهى:

- الهجين (١) IR64608A × IR35366-62-1-2-2-3R
- الهجين (٢) IR64608A × Suweon 287R
- الهجين (٣) IR68884A × Suweon 287R
- الهجين (٤) IR67701A × IR35366-62-1-2-2-3R

بمقارنتهما بالصنف التجارى "سخا ١٠٤" والسلالة النقية "IR64608B"

استخدمت ثلاثة مستويات من التسميد الأزوتى وهى ٢٥ و ٥٠ و ٧٥ كيلو جرام للفدان وثلاث مسافات للشتل وهى : ١٥ × ٢٠سم و ٢٠ × ٢٠سم و ٢٠ × ٢٥سم.

استخدم تصميم القطاعات المنشقة مرتين فى ثلاث مكررات حيث أحتلت مستويات التسميد الأزوتى القطع الرئيسية مسافات الشتل القطع الشقية الأولى والتراكيب الوراثي للهجين والأصناف القطع الشقية الثانية.

ويمكن تلخيص أهم نتائج الدراسة فى الأتى : وجدت فروقاً معنوية بين التراكيب الوراثية للهجن والأصناف للصفات تحت الدراسة. سجل الهجين (٢) أعلى محصول للحبوب للفدان ووزن الألف حبه وعدد الحبوب الممتلئة بالدالية وطول الدالية ومساحة الورقة العلم. كما أدت زيادة التسميد الأزوتى حتى ٥٠كيلو جرام للفدان الى زيادة معنوية فى محصول الحبوب بالفدان وعدد الحبوب الممتلئة بالدالية وكذلك عدد الداليات. أدت إضافة الأزوت بمعدل ٧٥كيلو جراماً للفدان الى زيادة معنوية فى عدد الداليات بالنبات ونسبة الحبوب الفارغة وطول الدالية ومساحة الورقة العلم وعدد الخلفات بالنبات وعدد الأيام اللازمة لطرد ٥٠% من الداليات وكذلك لارتفاع النبات. وأدت مسافة الشتل "٢٠ × ٢٥سم" الى الحصول على أعلى قيمة بالنسبة لتاريخ الطرد ومساحة الورقة العلم وعدد الخلفات للنبات وطول الدالية ونسبة العقم فى الدالية. هذا بينما سجلت مسافة الشتل "٢٠ × ١٥سم" أعلى قيمة بالنسبة لوزن الألف حبه ومحصول الحبوب للفدان. كما سجل الهجين (٣) أعلى قيمة لمحصول الحبوب بالفدان عندما شتلت النباتات على مسافة ٢٠ × ١٥سم وإضافة التسميد الأزوتى بمعدل ٧٥ كجم للفدان.