EFFECT OF NUMBER OF SEEDLINGS / HILL AND NITROGENOUS FERTILIZER LEVELS ON SK20334 HYBRID RICE VARIETY PRODUCTIVITY.

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ABESTRACT

Two field experiments were carried out at Etai El - Baroud Agricultural Research Station Farm (Behaira Governorate, Egypt), Agricultural Research Center (ARC), during 2004 and 2005 summer seasons to study the effect of number of rice seedlings / hill and different nitrogen levels on the productivity of SK 2034 hybrid rice variety. Thirty day old seedlings were transplanted on June, 10th with the rates of 1, 2, 3 and 4 seedlings / hill under nitrogen levels; i.e., 0,55,110,165 and 220 Kg N/ ha as urea form 46% N. A split plot design, with four replications, was used, where, the number of seedlings/ hill was laid in the main plots and the nitrogen levels were allocated in the sub- plots. All cultural practices were done as recommended.

The main findings show that, two seedlings/ hill, under 165 Kg N/ha significantly increased the number of panicles/ hill, panicle weight, number of filled grains / panicle, straw and grain yields and 1000- grain weight. Three seedlings/ hill, under 165 Kg N/ ha, significantly increased leaf area index, number of days to heading and plant height. Whereas, 220 Kg N/ ha significantly increased sterility and head rice %. The interaction was significant between number of seedlings / hill and nitrogen levels for the number of panicles/ hill and grain yield in both seasons.It was concluded that transplanting SK2034 hybrid rice with two seedling / hill at 165 Kg N / ha might produce the highest grain yield under the condition of study.

INTRODUCTION

Rice is vital to more than half of the world population. It is the most important grain food grain in the diets one of millions of Asian, Africans and Latin Americans (IRRI, 2000). Hybrid rice research in Egypt started in 1982 when the local Egyptian varieties were evaluated for

maintaining and restoring abilities, using two cytoplasmic male sterile Chinese varieties; namely, V20A and Zhen Shan 97. At that time, the Egyptian varieties (japonica type) showed very poor restoring ability (Maximos *et al* 1994). The commercial production of some line hybrid rice has expanded in some tropical Asian countries such as India, Vietnam and the Philippines. However, the area planted to hybrid rice is still quite small in these countries. The grain yield of commercial hybrid rice production in the tropics is lower than that in China (Vermani, 2001). The major limitations to the large-scale adoption of hybrid rice technology in the tropics are the inadequate level of standard heterosis of grain yield, poor agronomic management of hybrid rice, low yield of hybrid seed production, high seed cost and poor grain quality. Under favorable growing conditions, heterosis for grain yield is usually attributed to higher biomass production (Song, *et al* ;1990 and Yamauchi 1994).

To get the high productivity of rice crop to cover the population increase, an appropriate agronomic package is needed. Sowing date, seedling age, plant spacing, fertilizer levels and number of seedlings / hill are the most important factors, which limit rice yield. The present study aimed to investigate the optimum combination between number of seedlings/ hill and nitrogen level in SK 2034 hybrid rice variety.

MATERIALS AND METHODS

At the Experimental Farm of Eti El- Baroud, Agricultural Research Station (Behaira Governorate)(Agricultural Research Center), two field experiments were carried out in 2004 and 2005 summer seasons to investigate the effect of number of seedlings / hill and nitrogen fertilizer levels on the productivity of SK 2034 hybrid rice.

Thirty- day old seedlings were transplanted in plots, 3x5m in dimensions, at 20x20 cm planting spacing among hills and rows at the rate of 1,2,3 and 4 seedlings/ hill on June, 10^{th} in both seasons. Nitrogen fertilizer, as urea form 46% N, was applied at the rates of 0,55,110,165 and 220 Kg N / ha, as follows: - 1/2 basal in the dry soil during land preparation before flooding, 1/4 at panicle initiation (30 days after transplanting) and the last dose (1/4) was applied seven days before heading (65days after transplanting). A split- plot design, with four replications, was used. The main plots were occupied by the number of seedlings / hill and the sub- plots were occupied by nitrogen levels. The

experimental sites were prepared by two plowings and harrowing, then, carefully dried and wet leveled. During land preparation, each sub plot was fertilized with 38 Kg P_2O_5 in the form of super phosphate (15.5% P_2O_5). Zinc sulphate, at the rate of 24 Kg /ha, was mixed with fine sand and manually broadcasted in flooded soil before transplanting. Weeds were chemically controlled by using Saturn 90% at the rate of 2 L/ ha mixed with sand and manually broadcasted five days after transplanting. All cultural practices up to harvesting were done as recommended.

Studied characters: -

I-Vegetative characters: -

At heading time, plant samples were randomly collected from each sub plot to determine: -

1- Leaf area index (LAI).
   It was measured by using Leaf Area Meter (Model LI 300A).
2- Number of days to heading: -
   (from sowing up to 50% flowering).
3- Plant height (Cm).

Seven days before harvesting, plant height was measured for five random plants from each sub-plot from soil surface up to the top panicle of the main stem.

II-Grain yield and its components: -

Five days before harvesting ten random hills from each sub-plot were collected to determine the number of panicles / hill, and five panicle characters (panicle length, panicle weight, number of filled grains/ panicle, sterility % and 1000 grain weight). Ten square meters per sub-plot was manually harvested, then, left four days for air drying and mechanically threshed. Grain and straw yields were recorded and the grain yield was adjusted to 14% moisture content and converted to tons/ ha.

Harvest index was estimated according to the following equation;

Harvest index = Grain yield (t/ha)/ Grain plus straw yields (t/ha) X 100.

III- Grain quality characters:

About 250 g paddy rice random samples were dehulled, using Satake Testing Husker and polished by Mc Gill Miller No-Z at the grain quality lab, Rice Technology and Training Center (RTTC), Field Crops Research Institute, Alexandria. Egypt. Hulling, milling and head rice percentage were calculated, according to Khush, *et al* (1979). Data were

statistically analyzed according to Snedecor and Chochran (1981). LSD test at 5%level of significance, was calculated to compare among treatment means.

RESULTS AND DISCUSSION

1-*Vegetative characters*: -

Data in Table (1) summarize the effect of number of rice seedlings/ hill and nitrogen levels on LAI, number of days to heading and plant height in 2004 and 2005 seasons.

Data show that, transplanting of two seedlings / hill significantly increased leaf area index and plant height. This result means that, increasing number of seedlings / hill more than two seedlings/hill is not necessary for these two characters, because the differences among the numbers were not significant. While, no significant effect due to number of seedlings / hill was observed on number of days to heading in both seasons was obtained.

Concerning the effect of nitrogen fertilizer on these vegetative characters data showed that increasing nitrogen levels up to 165 Kg N/ha significantly increased leaf

Table 1: Some vegetative growth characters as affected by number of seedlings/hill and nitrogen levels in 2004 and 2005 seasons.

Main effects	LAI		No. of Days to heading		Plant height (cm)	
	2004	2005	2004	2005	2004	2005
A-No. of seedlings:						
1	5.16	5.72	92.6	93.2	96.5	96.2
2	6.32	6.32	92.8	93.1	101.7	102.1
3	6.52	6.61	93.6	93.8	103.3	103.7
4	6.71	6.81	93.6	93.7	101.9	102.2
F- test	*	*	NS	NS	*	*
LSD (5%)	0.41	0.42	1.8	1.2	4.1	4.0
B-N levels(Kg /ha):						
0	4.55	4.49	88.5	87.8	92.1	92.8
55	5.55	5.58	91.5	90.3	97.9	98.7
110	6.30	6.32	92.8	92.0	101.0	102.5
165	7.31	7.35	95.0	94.7	106.0	107.5
220	7.50	7.48	97.5	98.5	107.5	110.0
F- test	*	*	*	*	*	*
LSD (5%)	0.92	0.89	2.0	1.9	4.7	4.6
A X B F- test	NS	NS	NS	NS	NS	NS

NS : Not Significant * : significant at 5 % level.

area index and plant height, whereas, no significant differences were obtained between 165 and 220 kg N/ha for these two characters was obtained. While, increasing nitrogen level up to 220 kg N/ha significantly increased number of days to heading. Such result could be ascribed to the effect of nitrogen fertilizer in enhancing the rice plant vegetative growth and,hence delaying flowering. Ebaid and EL–Mowafy (2005) found similar results. Moreover,no significant effect due to the interaction between number of seedling / hill and N levels on these characters was detected in 2004 and 2005 seasons.

2 – Grain yield and its components:

Data in Table (2) present the effect of number of seedlings / hill and N levels on some panicle characters in 2004 and 2005 seasons.

Data show that, no significant effect due to number of seedlings one hill on panicle length in both seasons. While, two seeding / hill treatment was adequate for getting the heaviest Panicles and the largest number of filled grains / panicle in both seasons. These results are in agreement with those of Bisht *et al* (1999a) who reported that, the recommended two seedlings / hill for inbred rice varieties were optimum, even for the hybrids. Transplanting with two or three seedings / hill increased the total spikelets / panicle.

Data, also, indicate that increasing nitrogen up to 220 kg N/ha increased panicle length, panicle weight and number of filled grains / panicle. In fact 165 kg N/ha might be considered the optimum nitrogen level for these characters because no significant differences were noticed between 165 and 220 kg N /ha level in both seasons was obtained.

Data, also, show that no significant effect due to the interaction between number of seedlings / hill and nitrogen levels was detected on these panicle characters in both seasons was obtained.

Data in Table (3) indicate the effect of number of seedlings / hill and N levels on number of panicles / hill, and straw and grain yields in 2004 and 2005 seasons.

Data in Table (3) showed that, increasing the number of seedlings / hill up to three seedlings / hill significantly increased .Whereas, no significant different between three and four seedlings / hill for the number of panicle/ hill and grain yield characters.

Table 2: Panicle length, panicle weight and number of filled grains/ panicle as affected by number of seedlings/ hill and nitrogen levels in 2004 and 2005 seasons.

Main effects	Panicle length (cm)		Panicle weight (g)		No of filled grains /panicle	
	2004	2005	2004	2005	2004	2005
A-No. of seedlings:						
1	24.2	23.9	4.6	4.6	178.3	177.8
2	23.7	24.0	4.6	4.5	178.8	175.0
3	23.9	24.1	4.4	4.3	173.3	174.2
4	23.8	24.2	4.1	4.0	170.3	170.8
F- test	NS	NS	*	*	*	*
LSD (5%)	0.7	0.8	0.3	0.4	5.8	6.2
B-N levels (Kg /ha)						
0	23.2	24.1	3.9	4.1	150.5	153.2
55	23.2	24.2	4.0	4.4	165.8	168.4
110	24.0	24.0	4.4	4.5	171.3	175.4
165	24.8	24.8	4.8	4.9	186.4	188.2
220	24.9	24.8	4.8	4.8	185.6	188.9
F- test	*	*	*	*	*	*
LSD (5%)	0.6	0.5	0.3	0.2	5.7	5.1
A X B F- test	NS	NS	NS	NS	NS	NS

NS : Not Significant * : significant at 5 % level.

These data mean that three seedlings / hill were the optimum number of seedlings / hill in the tested hybrid variety. These data are inagreement with those reported by Bisht *et al* (1999 b) who found that, transplanting with two or three seedlings / hill increased the number of panicles / unit area. These results could be attributed to the absence of competition between two or three seedlings / hill for nutrients and sun light, which gave the rice plant a good chance for producing more productive tillers, consequently more panicles and grain yield.

Concerning the effect of nitrogen fertilizer effect, data, also, show that increasing N levels up to 165 kg N/ha significantly increased number of panicles / hill, grain and straw yields in both seasons. Whereas, no

significant differences between 165 and 220 kg N/ ha in both seasons was obtained. Data; also, show that applying 165 kg N/ha produced 12.18 and 12.10 t/ha grain yield in 2004 and 2005, respectively. This result could be attributed to the role of nitrogen fertilizer in producing more productive tillers and increasing physiological processes in rice plant. These data are in agreement with those Peng *et al* (2003). They reported that, grain yield was higher at a higher than t a lower N rate. That means that hybrid rice could be more profitable under high N input.

A significant effect due to the interaction between number of seedlings / hill and N level was detective on number of panicles / hill and grain yield in two seasons.

Table3: Number of panicles /hill and straw and grain yields (t/ha) as affected by number of seedlings/ hill and nitrogen levels in 2004 and 2005 seasons.

Main effects	No of panicles / hill		Straw yield (t/ha)		Grain yield (t/ha)	
	2004	2005	2004	2005	2004	2005
A-No. of seedlings :						
1	14.7	15.1	12.96	13.21	10.14	10.1[illegible]
2	17.9	18.2	14.23	14.50	11.04	11.12
3	18.3	18.4	14.70	14.82	11.66	11.71
4	19.5	19.2	14.87	15.00	11.77	11.79
F- test	*	*	*	*	*	*
LSD (5%)	2.0	2.1	0.37	0.40	0.35	0.41
B-N levels (Kg /ha) :						
0	12.9	13.2	9.9	10.21	8.83	8.72
55	15.4	15.7	13.36	13.82	11.10	11.0[illegible]
110	17.8	18.1	15.12	15.32	11.68	11.50
165	20.9	21.1	16.21	16.41	12.18	12.[illegible]0
220	21.0	22.0	16.30	16.37	12.08	12.03
F- test	*	*	*	*	*	*
LSD (5%)	2.2	2.1	0.53	058	0.27	0.21
A X B F -test	*	*	NS	NS	*	*

NS : Not Significant * : significant at 5 % level.

Data in Table (4), showed that the best combination between number of seedlings / hill and N levels for the largest number of panicles / hill was transplanting two seedlings /hill under 165 kg N/ha for hybrid rice SK 2034, which produced 23 panicles / hill.

On contrast, the lowest number of panicles / hill (11.0) was obtained when one seedling / hill was transplanted and no N fertilizer was added.

Table 4: Number of panicles / hill as affected by the interaction between number of seedlings / hill and nitrogen levels (average of two seasons).

No. of seedlings/ hill	N levels (Kg / ha)					Mean
	0	55	110	165	220	
1	11.0	12.0	15.3	15.3	20.0	14.7
2	12.3	15.7	17.7	23.0	21.0	17.9
3	13.4	16.0	18.0	22.7	21.0	18.3
4	14.7	18.0	20.3	21.0	22.0	19.2
Mean	12.9	15.4	17.8	20.5	21.0	17.5

LSD (0.05) :
1- N as number of seedlings at N levels =2.8
2- For N level at each number of seedlings =3.0

Data in Table (5) showed the interaction effect between number of panicles / hill and N levels on grain yield (t/ha). Data showed that, transplanting 2 seedlings / hill under 165 kg N /ha yielded the highest grain yield (12.83 t/ha). While transplanting 1 seedling / hill gave the lowest grain yield (7.73 t/ha) when no N was applied .

Table 5: Grain yield (t/ha) as affected by the interaction between number of seedlings / hill and nitrogen levels (average of two seasons).

No of seedlings/ hill	N levels (Kg / ha)					Mean
	0	55	110	165	220	
1	7.73	9.28	10.9	11.20	11.93	10.2
2	8.37	10.86	11.83	12.83	12.50	11.3
3	9.23	12.33	12.0	12.50	12.23	11.7
4	9.97	11.93	12.23	12.47	12.27	11.8
Mean	8.8	11.1	11.7	12.3	12.2	11.2

LSD (0.05) for :
1-Number of seedlings / hill under N levels =0.4
2- N level under each number of seedlings / hill =0.6

Data In Table (6) summarized the effect of number of seedlings / hill and N levels on 1000- grain weight, sterility % and harvest index in 2004 and 2005 seasons.

Table 6: 1000- grain weight (g), sterility (%) and harvest index as affected by number of seedlings/ hill and nitrogen levels in 2004 and 2005 seasons.

Main effects	1000- grain weight (g)		Sterility(%)		Harvest index	
	2004	2005	2004	2005	2004	2005
A-No of seedlings						
1	26.8	25.9	2.9a	3.6b	0.44	0.43
2	27.5	27.6	3.0a	3.8a	0.44	0.43
3	27.2	27.3	2.9a	3.5b	0.45	0.44
4	27.0	27.0	2.7a	3.8a	0.45	0.44
F- test	*	*	NS	*	NS	NS
LSD (5%)	0.3	0.4	0.3	0.2	0.01	0.01
B-N levels Kg /ha						
0	27.7	27.5	1.9	1.8	0.44	0.44
55	27.5	27.2	2.9	2.7	0.45	0.44
110	28.1	27.7	3.2	3.2	0.44	0.44
165	29.1	28.6	3.4	3.6	0.45	0.45
220	25.6	25.7	3.9	4.4	0.43	0.43
F- test	*	*	*	*	NS	NS
LSD (5%)	0.7	0.8	0.4	0.5	0.03	0.03
A X B F- test	NS	NS	NS	NS	NS	*NS

NS : Not Significant * : significant at 5 % level.

Data show that transplanting two seedlings / hill significantly increased 1000- grain weight in 2004 and 2005 seasons, while, no significant effects were observed on sterility (%) in 2005 and harvest index in both seasons was obtained.

Data show, also, that increasing nitrogen fertilizer up to 165 kg N/ha significantly increased 1000-grain weight because no significant differences between 165 and 220 Kg N/ ha. So, 165 Kg N/ ha might be the optimum rate of N that caused a high photosynthetic products required for a large sink size of hybrid rice, consequently, produced the highest 1000- grain weight.

On contrast, 220 Kg N/ ha decreased 1000-grain weight in both seasons. These results could be attributed to the high nitrogen level (220 Kg N / ha) which increased number of grains/ panicle, that demanded a

high quantity of photosynthetic products such as starch and sugars hence they were distributed among the large number of spikelets, consequently, produced light spikelets.

Data, also, showed that increasing nitrogen fertilizer up to 220 kg N/ha significantly increased sterility (%) in both seasons. These results could be ascribed to the high nitrogen level which produced more late tillers, consequently, more unfilled grains / panicle as a result of a short grain filling period. On the other hand, increasing nitrogen levels did not significantly affect the harvest index in both seasons.

No significant effect due to the interaction between number of seedlings / hill and N levels, was detected on these traits in both seasons.

3- Grain quality characters:

Data in Table (7) summarized the effect of number of seedlings / hill and N levels on hulling, milling and head rice percentage in 2004 and 2005 seasons.

Table 7: Hulling, milling and head rice percentage as affected by number of seedlings/ hill and nitrogen levels in 2004 and 2005 seasons.

Main effects	Hulling (%)		Milling (%)		Head rice (%)	
	2004	2005	2004	2005	2004	2005
A-No. of seedlings :						
1	79.5	79.3	71.7	71.9	63.6	63.7
2	79.7	79.4	71.9	72.0	63.8	63.8
3	79.8	79.5	71.9	71.9	63.9	63.9
4	79.8	79.6	71.9	72.0	63.8	63.9
F- test	NS	NS	NS	NS	NS	NS
LSD (5%)	0.9	0.9	0.8	0.8	0.5	0.5
B-N levels (Kg /ha)						
0	79.0	79.2	71.4	71.5	62.9	63.1
55	79.0	79.1	71.5	71.5	62.8	62.9
110	79.7	79.9	71.5	17.6	62.3	62.7
165	80.6	81.0	72.3	72.2	65.0	65.2
220	80.7	81.3	72.3	72.3	66.2	66.4
F- test	*	*	*	*	*	*
LSD (5%)	0.5	0.5	0.6	0.5	0.7	0.8
A X B F- test	NS	NS	NS	NS	NS	NS

NS : Not Significant * : significant at 5 % level.

Data in Table (7) show that no significant effects were obtained due to the number of seedlings / hill on hulling, milling and head rice percentage in both seasons.

Concerning the effect of N fertilizer, data show that increasing N levels up to 165 kg /ha significantly increased hulling. Milling and head rice percentage in both seasons this means that 165 kg N/ha was an adequate N level for hybrid rice the highest values of these grain this quality characters in SK. 2034. Ebaid and El –Hissewy (2001) found that increasing nitrogen levels up to 165 kg N/ha increased milled and head milled rice in Sakha 101 rice cultivar

Data show, also, that no significant effect, due to the interaction between number of seedlings / hill and N levels, on these grain quality characters in both seasons was obtained.

Finally, it could be concluded that at least transplanting two seedlings / hill and applying nitrogen fertilizer up to 165 kg N/ha might be considered the best combination for getting the highest grain yield and the best grain technological characters in SK 2034 hybrid rice under the experiment conditions

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الملخص العربي

تأثير عدد البادرات بالجوره ومستويات السماد النيتروجيني على إنتاجية صنف الأرز الهجين سخا ٢٠٣٤

رجب عبد الغنى عبيد و محمود أبو يوسف

قسم بحوث الأرز - معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية

أجريت تجربتان حقليتان بمزرعة محطة البحوث الزراعية بايتاي البارود (محافظة البحيره) مركز البحوث الزراعية وذلك خلال موسمى صيف ٢٠٠٤ و

٢٠٠٥ وذلك لدراسة تأثير عدد البادرات بالجوره ومعدلات التسميد النيتروجيني على إنتاجية صنف الأرز الهجين سخا ٢٠٣٤. وقد تم شتل البادرات التى عمرها ٣٠ يوم فى العاشر من شهر يونيو فى كلا الموسمين كالأتى : شتل بادره واحده و بادرتين و ثلاث بادرات و أربع بادرات بالجوره وذلك تحت خمسة معدلات من التسميد النيتروجيني وهى : صفر و ٥٥ و ١١٠ و ١٦٥ و ٢٢٠ كجم نيتروجين / هكتار فى صورة يوريا ٤٦ % نيتروجين. أستخدم تصميم القطع المنشقة مرة واحدة فى أربع مكررات حيث وضعت معاملات عدد البادرات / جوره فى القطع الرئيسية، بينما وضعت معدلات السماد النيتروجيني فى القطع المنشقة.

أ جريت جميع المعاملات الزراعية حسب التوصيات.

وقد أوضحت أهم النتائج المتحصل عليها ان :-

شتل ثلاث بادرات /بالجوره تحت مستوي ١٦٥ كجم نيتروجين /هكتار أدى الى زيادة معنوية فى الصفات الحضرية (دليل مساحة الأوراق و عدد الأيام حتى التزهير و ارتفاع النبات) بينما تسببت أضافه ٢٢٠ كجم نيتروجين هكتار الى زيادة معنوية فى نسبة العقم و الأرز الأبيض. أما شتل بادرتين / جوره تحت معدل التسميد ١٦٥ وحدة نيتروجين /هكتار فقد أدي الى زيادة معنوية فى صفات وزن الدالية، عدد الحبوب الممتلئة / الدالية ، عدد الداليات / جوره، وزن القش ، وزن الحبوب ووزن الألف حبة) . أما فيما يتعلق بالتفاعل بين عدد البادرات و معدلات السماد النيتروجيني فقد أوضحت النتائج ان هناك معنوية فى صفتي عدد الداليات / جوره ومحصول الحبوب فى كلا الموسمين.ويستنتج أنة للحصول علي اعلي إنتاجية من صنف الأرز الهجين سخا ٢٠٣٤ يلزم شتله بمعدل بادرتين / جوره تحت مستوي تسميد نيتروجيني ١٦٥ وحدة / هكتار وذلك تحت ظروف الدراسة .