SEEDLING VIGOR OF HYBRID RICE AS RELATED TO SEED RATE IN NURSERY UNDER SALINE SOIL CONDITION

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Abstract

Raising seedling vigor of hybrid rice is more needed to get full expression of high yielding heterosis. Two field experiments were conducted at the Agricultural Research Station farm at El-Sirw, Damietta Governorate, Egypt during 2003 and 2004 growing seasons to study the effect of various seed rates on seedling vigor of hybrid rice. The experiments were laid out in a split plot design with four replications, where hybrids viz, SK 2025H, SK 2058 H and SK 2047H occupied the main plots and the four seed rates namely, 20 30, 40 and 50 Kg seed /fed occupied the sub- plots.

The characteristics related to seedling vigor, viz number of white roots/plant, root length, root dry weight, number of tillers/ plant, shoot dry weight, shoot length, shoot/root ratio, number of leaves /plant were measured 25 days after sowing. The obtained results could be summarized as follows: various seed rates had significant effects on all studied traits. The low seed rate of 20 Kg seed /fed gave better seedling vigor of hybrid rice, moreover, it gave the highest number of white roots leading to quick recovery, highest number of tillers/seed, highest number of leaves/plant, high shoot/root ratio, longest and heaviest roots. Meanwhile, the highest seed rate of 50 Kg seeds/fed was the worst regarding seedling vigor. The hybrid rice varieties varied significantly in most of studied traits. The interaction effects were discussed in the results.

INTRODUCTION

Rice production has to increase at a much faster to feed the burgeoning, as it is an important cereal crop in Egypt. Of the several possible approaches for increasing rice production, hybrid rice technology seems to offer a great promise. In Egypt, this technology has just made a humble beginning, and in 2005 season, hybrid rice became available to farmers. For getting higher yield potential and proper net return, seeding rates as an important agronomic factor should be studied. In addition, sturdy seedlings i.e. good quality seedlings are much needed for getting considerable yield in which the seedling vigor was mainly affected by seed rate (Sattar *et al.* 1986). Clavijo and Baker (1988) evaluated seedling vigor of some rice cultivars, Mars, Saturn, Lemont and Bellemont as well as red rice. They found that red rice surpassed other tested cultivars regarding the shoot and root lengths and dry weights. Hari *et al* (2000) tested the seedling vigor of rice hybrids, Phb71and Pm52/IR31802, and claimed that PHB71 was more vigorous than PM52A/IR31802 in terms of high shoot and root dry weights and root and shoot lengths. El -Kallawy (2002) compared the seedling vigor of three rice cultivars viz. Sakha 101, Sakha 102 and Giza 178. He

reported that the short duration variety, Sakha 102 surpassed the two other varieties in shoot length and shoot dry weight, while Giza 178 was the best in root length, root dry weight and root /shoot ratio. Moreover, Sakha 101 had the largest leaf while the three tested cultivars didn't vary in leaf number /stem. The seed rate had a marked effect on seedling vigor in which the good quality seedlings promote early growth and ultimately increase the yield (Raghavaiah *et al.* 1989 and Arain et al 1990). They decided that the seedling produced from low seed density nursery had good quality seedlings and performed better. Kurmi and Sarmah (1993), Hari *et al.* (1997) and Rajendran and Veeraputhiram (1999) reported that low seed rate, 10 or 20 g/m has resulted in high seedling quality and gave proper shoot dry weight and leaf area /plant. El kallawy (2002) studied the effect of different seeding rates, from 30 to 80kg seed /fed on seedlings vigor. He found that low seed rate has significantly raised the seedlings vigor where it gave the highest values of root length, shoot length, shoot dry weight, root dry weight, root/shoot ratio, leaf area /plant and leaf number /stem. He reported that the tested rice cultivars markedly differed in their seedling vigor under various seeding rates. Also, Rieffel et al (2000) found that both convential and hybrid rices have differently responded to seed rates. The main objective of the current study is raising seedlings vigor of hybrid rice. In addition, applying the economic rate of seeds is important as the hybrid seeds are freshly needed every serason.

MATERIALS AND METHODS

Two field experiments were conducted at the Aricultural Research Station farm at El-Sirw, Damietta Governorate, Egypt during 2003 and 2004 growing seasons to study the effect of various seed rates on seedling vigor of hybrid rice. The experiments were laid out in a split -plot design with four replications. The main plots were assigned to three hybrids, k2025H, k2058H and Sk2047H. The sub-plots contained four seed rates, 20, 30, 40 and 50 kg seeds /fed. The area of each nursery was $4m^2$ which was divided into units to represent four replications. The corresponding rates were $57g/m^2$, $85g/m^2$, $114g/m^2$ and $142g/m^2$ for 20, 30, 40 and 50kg seeds/fed, respectively. Sowing dates in both seasons were on 10 May. The rest of cultural practices related to rice nursery were done according to package of recommendations of Ministry of Agriculture. During nursery preparation, the soil samples were taken into two depths, 0-30and 30-60 cm to assess the soil salinity levels according to Black (1965). The soil salinity level and PH value were 5.0ds/m and 8.2 , respectively, as an average of two seasons. Five samples from each replication were taken at 25 days after sowing (DAS), each sample consisted of 15 seedlings. The seedlings were carefully pulled to keep whole root and then transferred to the Laboratory to determine the following characters ,

1-White roots number/seedling : each plant was carefully separated with whole root and the white roots were counted.

2-Number of tillers/seedling. Each main plant was isolated with its formed tillers and then were counted.

3-Root dry weight g/15seedlings. Roots of 15 seedlings were carefully gathered ,washed, oven dried and then dry weight was recorded.

4-Shoot dry weight g/15 seedlings :It was determined by the same way of root dry weight.

5-Shoot/Root ratio : It was calculated by the following equation

$$\text{Shoot /Root ratio} = \frac{\text{Shoot dry weight (g)}}{\text{Root dry weight (g)}}$$

6- Leaf area /seedling : The leaf area of 15 seedlings were measured by leaf area meter and the average for one seedling was recorded .

7- Shoot length (cm) : It was determined for each sample in cm from the base to the tip of the tallest leaf blade .

8-Root length (cm): It was determined same way \as in shoot length.

9- Leaf number /seedling : Number of leaves /15 seedlings were counted and the average for one seedling was estimated.

The collected data were analyzed according to Gomez and Gomez (1984)

RESULTS AND DISCUSSION

1-White root number /seedling, tillers number /seedling and root dry weight g/15 seedlings:

For hybrid rice varieties performance in the three abovementioned traits, data in Table (1) showed that the three tested hybrids varied significantly in the white roots number /seedling, and root dry weight g/15 seedlings in both seasons. On other hand , they didn't show any variation in their tiller number/seedling confirming that seed density in nursery is the most critical factor affecting rice tillering in the nursery. It was found that SK2047H showed superiority in white root number /seedling in the second season, while in the first season, SK2058H was the higher in white root number with no significant differences with that of SK2047H. It is worthy to mention that white roots is considered as a good indicator for root activity whereas, transplanted seedlings with high number of white roots had faster recovery ehich promotes hybrid rice for early growth. Alghough SK2047H had higher number of white roots, it had the highest values of root dry weight in both seasons. Both hybrids, SK2025H and SK2047H were at par in root dry weight in both seasons. Similar results were reported by Clavija and Baker (1986), Hari *et al.* (2000) and El Kallawy (2002).

Seeding rate markedly affected the white root number /seedling ,tiller number /seedling and root dry weight g/15 seedlings in both seasons (Table1).The results showed that the increasing seed rate i.e. seed density has severely restricted seedling vigor, particularly in hybrid rice. So, these seedlings produced from low seed rate of 20 kg seed /fed were more vigorous than those produced from other rates .Thereby increasing seed rate up to 50 kg seed/fed consistently reduced white roots number /seedling, tillers number /seedling and root dry weight .The lowest values of the latter traits were produced using the high seed rate of 50kg seed/fed while the highest ones were produced by the low seed rate of 20 kg /fed. Tillers formed in nursery had high efficiency to produce more filled grains than those formed in the permanent field. Likewise, under low seed rate of 20kg seed/fed, the seedlings produced more than 4 tillers because the tiller primordium on the second and the third nodes was developed and tillers were appeared. On the other hand, under high seed density nursery , tillers from L2,L3 and L4 leaf axils often become dormant .The obtained data are in a good harmony with those reported by kurmi and sarmah (1993),Hari et al (1997) and El Kallawy (2002).

The interaction between hybrids and seeding rates had significant effect on white root number/seedling and number of tillers /seedling in 2003 season, while the same significance was found for root dry weight in both seasons (Table 2) . The best combination was SK2058H with 20 kg seed /fed in white root number /seedling followed by the combination of SK2047H with 20 kg seed /fed. Similarly, the combination of 20 kg seed /fed and Sk2025K gave the highest value of number of tillers /seedling (Table3). In contrary, Sk2025H with seed rate of 30kg seed /fed gave maximum value of root dry weight in both seasons (Table 4). On the other hand, under the high seed rate of 50 kg seed /fed all hybrids performed badly regarding the current traits. The obtained results completely agreed with those of El-kallawy (2002).

Table 1. Averages of white roots / plant, number of tillers / plant and dry root weight as influenced by three rice hybrids and seed rates at 25 days after sowing.

	White root/plant		Number of tillers /plant		Root dry weight/ 15 seedlings	
	2003	2004	2003	2004	2003	2004
Hybrid varieties	-	-	-	-	-	-
Sk2025H	7.19	7.813	2.59	2.53	6.011	7.250
Sk2058H	9.94	9.19	2.09	2.41	4.521	4.791
SK2047H	9.64	10.63	2.63	3.06	4.634	4.23
LSD0.05	0.60	0.56	NS	NS	0.25	0.62
Seed rate kg seed/ fed	-	-	-	-	-	-
20	11.417	12.00	3.458	4.500	6.858	7.383
30	10.250	9.667	2.458	2.833	5.500	5.867
40	7.417	8.250	2.083	1.917	4.167	4.333
50	6.583	6.917	1.750	1.417	3.700	4.103
LSD0.05	.82	.92	.40	.46	.35	.40
Interaction	**	NS	**	NS	**	**

Table 2. Averages of white root number / plant as affected by the interaction between hybrid rice varieties and seed rates during 2003 season .

Seed rate kg seed/fed	Hybrids rice varieties		
	Sk2025H	Sk2058H	SK2047H
20	9.750	11.500	13.000
30	7.000	13.250	10.500
40	6.250	8.000	8.000
50	5.750	7.000	7.000
L S D 0.05	1.43		

Table 3. Average of number of tillers / plant as affected by the interaction between hybrid rice varieties and four seed rates during 2003 season

Seed rate kg / fed	Hybrids		
	SK2025H	SK2058H	SK2047H
20	4.375	2.500	3.500
30	2.500	2.125	2.750
40	2.000	1.875	2.375
50	1.500	1.875	1.875
$L.S.D_{.05}$	0.7		

Table 4. Averages of root dry weight g/ 15 seedlings as affected by the interaction between hybrid rice varieties and seeding rates during 2003 and 2004 seasons

Hybrids	Seed rate kg /fed	Root dry weight g/15 seedlings	
		2003	2004
SK20 25 H	20	9.25	10.00
	30	6.78	7.88
	40	4.25	5.75
	50	3.78	5.38
SK 20 58 H	20	6.20	6.50
	30	5.08	4.43
	40	3.6	3.55
	50	3.2	3.28
SK 20 47 H	20	5.13	7.38
	30	4.64	5.87
	40	4.65	4.33
	50	4.13	4.11
LSD 0.05		0.62	0.70

2. Shoot dry weight g/15 seedlings , Shoot /root ratio and Leaf area cm^2 /plant.

Regarding the performance of hybrid rice varieties, data in Table 5 revealed that varietal differences were detected among the three tested hybrids in both seasons in all abovementioned traits except shoot dry weight in 2003 season. SK2047H surpassed the others giving the highest values of shoot dry weight in 2004

season and shoot/root ratio, and leaf area /plant only in 2003season, while SK2058H gave the largest leaf area in 2004season . From data in Table 6, it was noted that Sk2025H produced more root against shoot i.e. it had high proper balance between shoot and root production. Although Sk2025H gave considerable shoot dry weight, it gave the lowest value of shoot /root ratio. The latter fact means that SK2025H had high affinity to uptake more nutrient.

to meet the requirements of shoot development and ultimately grain yield formation .Also , SK2025H gave the narrowest leaf area in both seasons only, in 2004 season ,SK2058H gave the largest leaf area and lowest value of shoot dry weight in both seasons . Similar results have been reported by Clavijo and Baker (1986), Hari et al (1997) and El Kallawy (2002).

As for seeding rates effect ,the obtained data demonstrated that the varying seeding rates had affected shoot dry weight ,shoot/root ratio ,and leaf area /seedling in both seasons (Table 5).Increasing seeding rates significantly diminished the shoot dry weight and leaf area /seedling while , it increased shoot /root ratio in both seasons .The low seed rate of 20kg seed /fed gave the lowest shoot/root ratio i.e. highest value of root/shoot ratio .In contrast ,high seed rate of 50kg seed/fed gave the highest values of shoot dry weight and leaf area /seedling while, it gave the lowest value of shoot/root ratio in 2003 season .It seem that the high seed density resulted in overcrowdedness leading to more competition ,weak plants ,very then seedling ,less shoot dry weight, narrow leaves poor root system and very poor quality seedlings .So, that shoot dry weight could be one of the efficient factors associated to vigorous seedlings in the nursery .Also, from forgoing discussion related to root dry weight and shoot /root ratio (especially the latter parameter) ,it can be noticed under high seed density the distribution and absorption area of roots is smaller ,consequently , number of roots developed became fewer .In spite of large of number of roots primordia were found but the root could not emerge and became dormant because of seedling overcrowdedness .From the physiological view ,many roots can not be differentiated in relation to available space .Thereby , the root developments in the permanent field become less and small (Hoshikawa 1989).In addition ,the root dry weight and shoot/root ratio appear to be major factors in competitive ability in nursery .Similar findings have been reported by Clavijo and Baker (1986), Kurmi and Sarmah (1993), Hari *et al.* (2000) and El Kallawy (2002).

Concerning the interaction effect , hybrids and seeding rates had significant impact on shoot dry weight ,shoot /root ratio and leaf area /plant in both seasons (Table 5) .The combination of SK2025H and low seed rate of 20kg seed /fed was the best in shoot dry weight and shoot /root ratio (Tables 6 &7). Meanwhile, the combination of

SK2047H and low seed rate of 20 kg seed /fed had the largest leaf area /seedling in both seasons (Table 8). The worst combination in shoot dry weight was SK2058H with high seed rate of 50kg seed /fed. while it was Sk2047H with 50kg seed /fed in root /shoot ratio ,In the leaf area ,the bad combination was SK2025H with 50Kg seed /fed In the second season ,the leaf area of Sk2058H wasn't affected by any seed increment beyond 20 kg seed /fed . The current data are in a good agreement with those reported by El Kallawy (2002).

Table 5. Averages of shoot dry weight g/15seedlings, shoot/root ratio and leaf area/ plant at 25 DAS as affected by hybrid rice varieties and seed rates.

Traits	shoot dry weight g/15 seedlings		shoot /root ratio		leaf area /plant	
Effects	2003	2004	2003	2004	2003	2004
Hybrid entries	-	-	-	-	-	-
SK2025H	9.41	9.38	1.72	1.45	26.69	26.88
SK2058H	8.83	8.83	2.03	1.91	32.22	36.65
SK2047H	9.31	10.98	2.08	2.58	41.00	30.26
LSD0.05	NS	.0.48	0.16	0.17	1.39	0.66
Seed rate kg/fed	-	-	-	-	-	-
20	9.89	12.13	1.53	1.73	41.65	38.78
30	9.46	10.49	1.77	1.91	33.01	31.34
40	9.03	8.63	2.21	2.14	31.06	28.16
50	8.33	7.66	2.37	1.99	27.65	26.76
$L S D_{0.05}$	0.53	0.33	0.15	0.15	2.4	0.77
interaction	**	**	**	**	**	**

Table 6. Averages of shoot dry weight g/15 seedlings as affected by the interaction between hybrid rice varieties and seeding rate.

hybrids	seed rats kg seed/fed	shoot dry weight g/15 seedlings	
		2003	2004
sk20 25 H	20	11.58	12.50
	30	9.38	9.30
	40	8.38	8.43
	50	8.30	7.30
Sk 20 58 H	20	10.38	10.5
	30	9.21	9.35
	40	9.35	8.20
	50	6.38	7.25
Sk 20 74 H	20	7.73	13.38
	30	9.80	12.83
	40	9.38	9.28
	50	10.33	8.43
LSD0.05		0.93	0.57

Table 7. Averages of shoot /root ratio as affected by the interaction between hybrid rice varieties and seeding rate.

hybrids	Seed rate kg /fed	Shoot /root ratio	
		2003	2004
SK20 25 H	20	1.25	1.25
	30	1.39	1.19
	40	1.98	1.51
	50	2.26	1.38
SK 20 58 H	20	1.68	1.62
	30	1.81	1.77
	40	2.63	2.24
	50	2.00	1.99
SK 20 47 H	20	1.65	2.31
	30	2.11	2.78
	40	2.02	2.66
	50	2.25	2.58
LSD0.05		0.30	0.63

Table 8. Averages of leaf area cm^2 /seedling as affected by the interaction between hybrid rice varieties and seeding rate.

hybrids	Seed rate kg /fed	Leaf area (cm^2)/seedling	
		2003	2004
Sk20 25 H	20	35.81	37.25
	30	26.03	26.50
	40	22.47	22.73
	50	22.45	21.03
sk 20 58 H	20	37.78	39.23
	30	35.84	36.03
	40	31.86	35.01
	50	23.43	36.25
sk 20 47 H	20	51.36	39.88
	30	37.18	31.50
	40	38.86	26.65
	50	36.30	23.00
LSD0.05		3.65	1.34

3-Root and Shoot length, and Leaf number /shoot:

As for hybrid performance, data in Table 9 showed that the three hybrids differed significantly in shoot length in both season. Meanwhile, root length/plant and leaf number/plant of the three hybrids were only different in the second season. The hybrid SK2047H gave the reasonable value of root and shoot lengths. The first hybrid, SK2025H occupied the second rank after SK2047H in shoot length. For leaf number /seedling, it was detected that the hybrid Sk2058H had the maximum leaf number /seedling in both seasons. As it was previously claimed that the hybrid variety SK 2047H had high white root number /seedling. So, the previous results lead to the fact that there is a close relationship between white roots and shoot system development in the nursery and permanent field. Also, there is another finding that Sk2047H could

reach to leaf age as short duration variety (optimum transplanting age) faster than the other two hybrids. Thereby, it could be recommended that SK2047H has to be transplanted as earlier as possible. From the forgoing discussion, Sk2047H gets its recovery faster than other ones. Similar findings have been demonstrated by Hari et al (2000) and El-Kallawy (2002).

With respect to seeding rates effect , data listed in Table 9 showed that the varying seed rates had significant effect on root and shoot length and leaf number /seedling except in the first season, where the used seed rates failed to exert any significant effect on shoot length. The highest values of root and shoot length and leaf number /stem were produced when the low seed rate was used in this study. Generally, the increasing seed rate up to 50kg seed /fed significantly has restricted the shoot and root length, and the leaf number/stem. So, the lowest values of the aforementioned traits were obtained when the hybrids were seeded with high seed rate of 50kg seed /fed. Thus, the leaf number /seedling was sharply affected by increasing seed rate than root and shoot length. Also, the latter fact was correct with white root number as well as shoot and root dry weights. Thereby, the length seems to be less affected by seed rate particularly the shoot length. The leaf number /seeding could be attributed to the good development of hybrid rice in nursery and permanent field. These data could be attributed to low seed rate in nursery, the seedlings are grown under eough light for developing the first and second leaves as faster as possible. .However, the high seed density in nursery reduced the light intensity because of mutual shading among the seedlings which resulted in delaying in leaf development.

Pertaining to the interaction effect, data presented in Table (9) assured that the interaction between hybrid rice varieties and seed rates had significant effect on root and shoot length during both seasons. The hybrid variety Sk2047H with low seed rate of 20kg /fed gave the tallest roots. Meanwhile, the shortest roots were produced by SK2058H with 50kg seed/fed in 2004 season and SK2047H with the same seed rate in 2003 season. The longest shoot was produced by SK2047H with low seed rate of 20 kg seed/fed while the shortest shoot was by SK2025H with high seed rate of 50kg seed /fed and also with the low seed rate of 20 kg seed/fed, SK2058H gave the highest value of leaf number /seedling (Tables 10,11&12). Similar data are in a good harmony with those reported by El -kallawy (2002).

Finally, it could be concluded that the seedlings with more white root number, high root /shoot ratio, high shoot and root dry weights, and more leaf number /seeding as well as tiller number /seedling at 25 days after sowing are more vigorous. The low seed rate in the nursery result in raising seedling vigor of hybrid rice .The low seed density contributed to forming more tillers and leaf /seedling as faster as possible

than high seed density. The low seed rate enhanced the seedling vigor leads to accelerate early rice growth particularly hybrids ones with high yield potentiality. From the point of view of increasing rice salt tolerance, the high seedling vigor is an important way to increase the salt tolerance in which high seedling vigor can dilute salt uptake through vegetative growth.

Table 9. Average of root length /plant, shoot length /plant and leaf number / plant at 25 days after sowing as affected by rice hybrids and seed rates.

Traits	Root length cm/plant		Shoot length cm/plant		Leaves number /plant	
Effects	2003	2004	2003	2004	2003	2004
Hybrid entries	-	-	-	-	-	-
SK2025H	11.74	12.19	23.09	25.37	4.84	3.88
SK2058H	11.44	11.63	21.75	24.84	4.72	4.49
SK2047H	12.26	12.96	23.94	26.98	4.35	3.97
LSD0.05	NS	0.97	1.66	1.09	NS	0.45
Seed rate kg/fed	-	-	-	-	-	-
20	14.06	14.54	23.33	26.75	6.00	5.95
30	12.013	12.5	22.17	26.08	4.74	4.23
40	10.963	11.56	22.96	25.04	4.48	3.26
50	10.13	10.43	23.25	25.04	3.88	3.02
L S D $_{0.05}$	0.98	0.91	NS	1.34	0.56	0.33
interaction	**	**	NS	**	NS	**

Table 10. Averages of root length /seedling as affected by the interaction between hybrid rice varieties and seeding rates.

Hybrids	seed rats kg seed/fed	Root length cm	
		2003	2004
SK20 25 H	20	12.67	12.3
	30	12.50	12.5
	40	11.43	12.03
	50	10.38	11.05
SK 20 58 H	20	12.50	13.68
	30	11.88	12.00
	40	10.78	10.95
	50	10.63	9.88
SK20 47 H	20	17.00	16.75
	30	12.00	13.00
	40	10.70	11.70
	50	9.38	10.38
LSD 0.05		1.71	1.58

Table 11. averages of shoot length (cm) as affected by the interaction between hybrid rice varieties and four seed rates during 2004 season

seed rates Kg / fed	hybrid varieties		
	SK 2025 H	SK 2058H	SK2047H
20	27.85	24.38	28.03
30	25.36	25.13	27.75
40	24.50	23.38	27.25
50	23.75	26.50	24.88
L.S.D0.05	2.43		

Table 12. Averages of leaves number / plant as affected by the interaction between hybrid rice varieties and four seed rates during 2004 season.

seed rates Kg seed / fed	hybrid rice varieties		
	SK2025H	SK2058H	SK2047H
20	5.75	6.30	5.73
30	3.75	5.17	3.78
40	3.00	3.20	3.5
50	3.00	3.30	2.80
L.S.D0.05.	0.6	-	

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قوة بادرات الأرز الهجين المرتبطة بمعدلات التقاوى فى المشتل تحت ظروف التربة الملحية

بسيونى عبد الرازق زايد ، على عبد الله أبو خليفه ، حمدى فتوح الموافى

مركز البحوث والتدريب فى الأرز – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

أقيمت تجربتان حقليتان بمزرعة محطة البحوث الزراعية بالسرو – دمياط خلال موسمي ٢٠٠٣ ، ٢٠٠٤ لدراسة تأثير معدلات تقاوي مختلفة فى المشتل على قوة بادرات بعض هجن الأرز. وذلك لأن رفع قوة بادرات أصناف الأرز الهجين تكون أكثر أهمية للحصول على قوة الهجين الكاملة بالأرز الهجين. وعليه كان تصميم التجربة هو قطع منشقة مرة واحدة فى أربعة مكررات وتم توزيع أصناف الأرز الهجين , Sk2025H, SK 2058H, SK 2047 H فى القطع الرئيسية ومعدلات التقاوي فى القطع المنشقة وكانت كالآتي ٢٠، ٣٠، ٤٠، ٥٠ كجم / فدان.

وكانت أهم النتائج المتحصل عليها كالأتي :

وجد أن هناك تأثيرا معنويا لمعدلات التقاوي على الصفات المدروسة وهى عدد الجذور البيضاء / البادرات ، طول البادرة للساق والجذور ، الوزن الجاف للساق والجذور وعدد الأوراق/ البادرة ومساحة الأوراق وكذلك نسبة الجذور/ السيقان.

أعطى معدل التقاوي الأقل (٢٠ كجم / فدان) أفضل القيم للصفات المذكورة أعلاه ونجح فى تحقيق وإنتاج بادرات ذات جودة عالية ، أما المعدل الأعلى فكان الأسوأ بالنسبة لتلك الصفات.

ومن ناحية أخرى تباينت الهجن فيما بينها فى الصفات المقاسة وظهرت كذلك تأثيرات معنوية للتفاعلات فى الصفات المختلفة.