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RESPONSE OF MAIZE CUITIVARS TO DIFFERENT MANAGEMENT REGIMES

Ahmed, M.A. and M.H.EL-Sheikh
Crop Science Dept., Faculty of Agriculture (EL-Shatby), Alexandria University, Alexandria, Egypt.

ABSTRACT

Two field experiments were carried out at the Agricultural Experimental Farm of Alexandria University, during the two summer seasons of 1996 and 1997. Each experiment included sixteen maize (*Zea maize*, L.) cultivars consisting of eight single crosses, seven three-way crosses and one synthetic open-pollinated cultivar. The studied treatments included Four management regimes. These were; 40,000 plants/ha + 150 Kg N/ha, 60,000 plants/ha + 150Kg N/ha, 40,000 plants /ha + 300 kg N/ha and 60,000 plants /ha + 300 kg N/ha. Split plot design in three replicates was used.

The obtained results showed that , grain yield and most of its components were highly significantly affected by the management regimes. The top yielding regime was (60,000 plants/ha + 300 kg N/ha)) with an average across the two seasons of 9.33 t/ha, in comparison with 4.47 t/ha for the low yielding regime (40,000 plants/ha + 150 Kg N/ha). The other two studied regimes were intermediate in grain yield.

The maximum grain yield obtained from (60,000 plants/ha + 300 Kg N/ha) regime was mainly due to its high number of plants/ha which reached at harvest about 150% of that obtained with 40,000 plants/ha. However, that increase in number of plants was associated with a slight decrease in yield components namely; number of ears/plant, kernel weight and ear size (length x diameter). This study obviously indicated that maize hybrid, S.C.10. was consistently the top yield one in the two seasons, while the high yielding hybrids, S.C. “Bachear 13”, S.C. 124 and S.C. 129, Fluctuated in their rank across the two seasons. The high yielding hybrids were characterized by heavier kernel weight and larger ear size (length x diameter).

Although the interaction between cultivars and management regimens was significant, this interaction did not effect the rank of the cultivars. The correlation coefficient between the mean yield at the eight environments ranged between 0.883 to 0.987 and were highly significant from zero. This would indicate that cultivar rank was consistent at the eight environments. In the future one regime would be enough to predict the yield potentiality of the different cultivars. The significant interaction might be due to magnitude of the different between the cultivars rather than their rank. The recent results would suggest that regime 4 (60,000 plants/ha + 300 kg N/ha) would be recommended for the evaluation of the cultivars for both the high and low productive level.

INTRODUCTION

Maize is the major summer cereal crop grown in Egypt. Its total acreage reached about 900,000 ha in 1995, with an average growth rate of 1.3% per year. The average maize yield, in Egypt, was about 5.5 t/ha and the total maize production amounted to 5.5 million tons in 1995 (Egyptian Ministry of Agriculture and Land Reclamation Statistics 1995). To increase the average yield/ha, farmers have to grow high yielding cultivars and improve their cultural practices. The Egyptian Ministry of Agriculture and Land Reclamation succeeded in releasing several high yielding maize

hybrids, mostly as single and three-way crosses. These hybrids are either of white or yellow grains. Also, the Egyptian private sector produced several high yielding hybrids. All of these hybrids were evaluated by the Ministry under optimum cultural practices and the best ones were commercially recommended to the farmers. It was estimated that only 30% of the total maize area was planted with improved hybrids (CIMMYT, 1994).

The Egyptian farmers grow maize under different crop managements, some of them prefer to grow their maize under wide spacing, as their criterion for higher yield is the grain yield/plant. Whereas, the Ministry of Agriculture is recommending a plant population of 60,000 plants/ha, which is higher than that grown in the farmers field. Besides, the farmers are applying different nitrogen fertilizer rates and most of them believe that maize requires a high level of nitrogen fertilizer. However, a high percent of maize farmers can not afford such high N levels. The Ministry of Agriculture is recommending the application of 300 kg N/ha when growing the recommended hybrids (Anonymous, 1996).

Another dilemma facing the Egyptian maize farmers is the choice of the proper hybrids. The interaction between hybrids and management regimes may affect proper choice of the most suitable hybrids. Salem (1968), Ahmed (1989), Nawar *et at* (1992) and Esmail and El-Sheikh (1994) found that increasing nitrogen level up to 120 kg/fed. caused a significant increase in grain yield of maize and its components. The objectives of the present investigation were:

1. To assess the recommended maize cultivars with respect to grain yield, yield components and plant characters under different management regimes.
2. To study the interaction between cultivars and management regimes in order to identity the most suitable cultivars for the different management regimes.

MATERIALS AND METHODS

Two field experiments were carried out at the Agricultural Experiment Station of the Faculty of Agriculture, University of Alexandria, during 1996 and 1997 summer seasons. Sixteen maize cultivars, consisting of eight single crosses (S.C.9, S.C.10, S.C. Bachearl3, S. C.122, S.C.123, S.C.124, S.C.129 and S.C.Watnia 4), seven three way crosses (T.W.C. 310, 320, 321, 322, 323, 324 and a synthetic cultivar (Alex4).

All of these cultivars were high yielding and of full season, with white grains. Each experiment was conducted as a two-factor experiment in a split-plot design with three replications. The main plots were assigned to the four management regimes, which consisted of the combination of two nitrogen fertilizer levels of 150 and 300 kg N/ha and the two plant populations of 40,000 and 60,000 plants/ha. These four management regimes (MR) were: MR_1 = 40,000 plants/ha + 150 kg N/ha, MR_2 = 60;000 plants/ha + 150 kg N/ha, MR_3 = 40,000 plants/ha + 300 kg N/ha and MR_4 = 60,000 plants/ha+300kg N/ha. The source of nitrogen fertilizer was urea (46.5%).

The amount of N fertilizer was splitted into two increments, the first was applied 25 days and the second 40 days after planting. Within each main plot, the different cultivars were planted in two-row plots. Each row was 5m in length and 7Ocm apart. Within ridges the spaces among hills were 36 cm for the 40,000 plant population and 24cm for the 60,000 plant populauon. Plots were sown at the optimum date of mid-may at the rate of three grains per hill, which were thinned later into a single plant/hill.

Data were collected on grain yield, yield components and several agronomic characters. The statistical analysis of variance was separately performed for each season, as outlined by Steel and Torrie (1980). Both management regimes and cultivars were treated as fixed effects.

RESULTS AND DISCUSSION

I. Effect of Management Regimes :

1. Grain yield and its components :

Analysis of variance for grain yield and its components of maize cultivars under the four management regimes for the two seasons (1996 and 1997) are given in Table (1). In the first season, the differences among the four management regimes were highly significant for grain yield, number of ears/plant, ear length, ear diameter and 100-kernel weight. In 1997 season, similar effects were obtained, except for 100-kernel weight that was not significant.

Means of grain yield and its components for the four management regimes are summarized in Table (2). The two management regimes (60 M + 150 N) and (60 M + 300 N) recorded the highest mean values for grain yield in both seasons (9.728 and 8.931 t/ha) and were significantly higher than the two other regimes. In the two successive seasons, the (60 M 300 N) regime was the top yielding one. On the other hand, the (40 M + 150 N) regime gave the lowest productivity in the two seasons, being 4.417 and 4.516 t/ha, respectively. Table (2) further shows that the two management regimes (40 M + 150 N) and (40 M + 300 N) recorded the highest means for the number of ears/plant, whereas, the two other regimes gave the lowest mean values in both seasons. Moreover, Table (2) indicates that the management regime (40M+150N) resulted in the longest significant ear length (18.72 cm), compared with the three other regimes. In 1997, however, the two management regimes (40 M+150N) and (40 M + 300 N) recorded significantly longer ears than the two other regimes, being 18.80 and 18.79 cm, respectively Concerning the ear diameter, it was observed that the management regimes, (40 M+150 N), (60M+150 N) and (40 M + 300 N), produced the highest significant ear diameter (ranging from 4.52 to 4.55 cm). While, the (60M + 300 N) regime produced the lowest ear diameter (4.46 cm), as shown in Table (2). Furthermore, in 1997, the two management regimes (40 M + 300 N) and (60 M + 300 N) recorded the highest significant mean ear diameter values (4.66 cm), but the two other regimes produced the lowest ear diameter (4.58 cm).

1+2

Insofar, as the 100 -kernel weight was concerned, the management regime (40 M + 300) recorded the highest significant mean value-(29.89 g) in 1996. While, in 1997, the management regime (60 M+150 N) produced the highest significant mean value (29.42 g), as indicated in Table (2). In conclusion, it can be stated that the top yielding regime was that of (60 M + 300 N) as it produced a mean of 9.331 t/ha over the two seasons, in comparison with 4.467 t/ha for the lowest input management (40 M + 150 N) one. The two other regimes were intermediate in grain yield (6.986 t/ha.).The present results were in agreement with those reported by several investigators conducting their experiments under irrigation, such as Olson and Sander (1988), Nawar e*t al. (1992),* Badr *et al*. (1993), El-Sheikh and El-Shamarka (1994), Shalaby *et al.*(1994), Younis *et al*.(1994) and Ali *et al.*(1996). Moreover, the Egyptian Ministry of Agriculture and Land Reclamation is recommending the growing of its new maize hybrids under a population of 60 M plants and applying up to 300 kg N/ha (Anonymous, 1996). The highest grain yield, obtained from the (60 M + 300 N) regime, was probably ascribed to the larger number of plants/ha (60 M), which reached 50% over the 40 M plants/ha population. However this increase in number of plants per unit area was associated with a slight decrease in the grain yield components; namely, number of ears/plant, kernel weight and ear size (ear length x ear diameter). Such decrease, however, amounted to less than 10% and did not deleteriously affect the high grain yield caused by the increase in number of plants/ha.

2. Agronomic characters :

Data were taken on silking date, plant height and ear height. The analysis of variance for these characters of maize cultivars under the four management regimes for the two seasons was given in Table (3). In both seasons, the differences were highly significant among the four management regimes and the tested cultivars for these traits, except for silking date for which the differences were insignificant. Means of agronomic characters for the four management regimes are summarized in Table (2). It is clear in this table that the high density regimes gave significantly taller plants (an average of about 224.5 cm) than the lower ones (an average of about 216.4 cm) in the two seasons. Moreover, Table (2) shows that, in both seasons, the low density regimes gave the lowest ear position on plant stalks, being about 99.1 cm on the average, compared with the high density regimes (about 103.6 cm). Concerning silking date, the four management regimes had nonsignificant influence on it in both seasons. In conclusion, it can be stated that the increased in number of plants/ha resulted in taller maize plants and higher ear position than the lower plant numbers.

Table (3): Analysis of variance for some agronomic characters of maize cultivars under four management regimes in 1996 and 1997 seasons.

S.O.V.	d.f.	Silking date (days)		Plant height (cm)		Ear length (cm)	
		1996	1997	1996	1997	1996	1997
Replications	2	0.328	0.328	18.396	21.005	19.141	76.422
Managements (M)	3	1.243	0.541	2385.7**	26.01**	527.38**	256.78*
Error (a)	6	0.154	0.641	4.826	10.977	2.266	55.095
Cultivars (C)	15	4.099**	6.933**	2861.4**	2109.3**	929.08**	746.68**
C x M	45	0.617**	0.504	18.78**	4.09**	13.694**	54.831
Error (b)	120	0.348	0.335	3.052	5.251	2.007	58.604

***, ** indicate significance at 0.05 and 0.01 levels of probability, respectively.**

II. Effect of Cultivars :

1. Grain yield and its components :

The analysis of variance for grain yield and its components of the sixteen cultivars of maize in the two seasons is given in Table (1). This table reveals that the tested cultivars were highly significantly variable for grain yield and its components in the two successive seasons.

The mean values for cultivars averaged over the four management regimes, for grain yield and its components are given in Table (4). Values of these means, in 1996, ranged between 4.729 to 9.821 t/ha, with an overall mean value of 7.072 t/ha. It is worthy to note that the superior cultivars in grain yield are single crosses (from No.1 to No.7). In addition, in 1997 season, the overall grain yield mean was 6.765 t/ha, which ranged between 4.713 to 9.571 t/ha. The most superior cultivars in grain yield, also, were the single crosses, as in the first season (Table 4).

Furthermore, Table (4) shows that the number of ears/plant ranged between 1.08 to 1.14, in1996, and 1.10 to 1.14 in 1997. It appears that no obvious association was noticed between grain yield and such number, since their mean values differed in their rank order.

Table (4) further reveals that the cultivar mean values of ear lengih, in 1996, ranged between 6.23 (for Alex-4) to 20.06 cm (for S.C.10). The same trend, also, was observed in 1997 season, where the mean values ranged between 16.60 to 20.25 cm for both cultivars, respectively. It is clear in Table (4) that the mean values for ear length and grain yield showed almost similar ranks, which indicates a strong association between them, where the longest ear length (about 20 cm) and the heaviest grain yield (about 9.2 t/ha) were those for S.C.10, over both seasons. On the other hand, Alex-4 gave the shortest ear length (about 16.4 cm) and the least grain yield (around 4.2 t/ha).

Moreover, data in Table (4) indicated that the ear diameter mean values ranged between 4.18 cm (for Alex- 4) to 4.83 cm (for S.C. 10) in 1996. A similar trend was observed in 1997, where the mean values ranged between 4.23 to 4.93 cm for the same cultivars. It is worthy to note that the thickest ears belonged to S.C.1O, S.C. Bachear 13, S.C.124 and S.C.129, since their ear length and diameter ranked higher. Additionally, it was noticed that a relatively strong association was observed between grain yield and each of ear length and diameter, where top -yielding cultivars produced the thickest ears.

Moreover, data in Table (4) revealed that the mean of 100-kernel weight ranged between 26.32 to 32.05 g and 26.67 to 32.13 g in the two respective seasons, for Alex-4 and S.C.10, respectively. In fact, most of the single crosses had the heaviest significant 100-kernel weight (28.25 - 32.13 g). Alex-4 had the lightest 100-kernel weight (about 26.5 g) over the two seasons. The high yielding cultivars, also, were the higher in 100-kernel weight, indicating that such weight might be a good indicator for grain yield and an important component of it. This conclusion could be supported by the association between the low grain yield of Alex-4 and the lightest 100-kernel weight. The superior high yielding hybrids were characterized by heavier 100-kernel weight and larger ear size (length x diameter). However, the differences were relatively small in number of ears/plant. Both kernel weight and ear size showed the strongest genetic correlation with grain yield (Hallauer and Mirarda, 1981). Also, Carlone and Russell (1987) showed that the highest correlation coefficient with grain yield was attributed to ear length. They showed a significant interaction between cultivars and nitrogen levels or plant densities and concluded that each cultivar had a specific density x N combination.

2-Agronomic characters :

The analysis of variance of maize cultivars showed highly significant differences for silking date, plant height and ear height in the two seasons, as indicated in Table (3). Means of number of days to mid-silking are given in Table (5). Such number ranged between about 57.2 to 60.0 days, in 1996 season, and between 57.3 to 60.5 days, approximately, in the second season (Table 5).

Data in Table (5) further showed that plant height means varied from about 202.3 to 252.8 cm, in 1996, and from 192.4 to 239.2 cm in 1997 The tallest significant cultivars included S.C.9, S.C.1O, S.C. Bachear 13, S.C.124 and S.C.129, whereas, the shortest ones included S.C.122, S.C.123 and Alex-4. Furthermore, data reveals that ear height means differed from about 81.8 to 118.9 cm in 1996 season and from about 84.1 to 113.6 cm in 1997. Apparently, the mean values for both plant and ear height gave a similar trend in their order, hence, they might be highly correlated. Tallness is a highly heritable character and it is weakly associated with grain yield, as reported by Hallauer and Miranda *(1981)* and stated that the genetic correlation coefficient was 0.81 between plant and ear heights-while it was only 0.30 between either plant or ear height and grain yield.

In conclusion, it can be stated that S.C.10 maize hybrid was consistently the top yielding one in the two seasons. Whereas, the high yielding hybrids, S.C.Bachear 13, S.C.124 and S.C.129, fluctuated in their rank across the two seasons. Among the grain yield components, the heaviest grain weight and ear size were associated with the top yielding cultivars. This conclusion was confirmed by the findings of Nawar *et al.* (1992), EI-Sheikh (1994), EI-Sheikh and EI-Shamarka (1994), Esmail and EI-Sheikh (1994) and El-Mokadem (1997).

3. Effect of interaction

The interaction was highly significant among cultivars x management regimes over the two seasons for grain yield and the related agronomic characters except for ear diameter in the first season and number of ears/plant, ear length and 100-kernel weight, silking date and ear height in the second season.

Mean grain yield (t/ha) for the cultivars under the different management regimes are given in Table (6). The relative rank of different cultivars at the different management regimes were; almost similar. S.C.10 consistently ranked the first at the eight environments. While, Bachear 13 ranged between the second and the third. On the other hand, Alex. - 4 was the lowest yielding cultivar at the eight environments. Therefore, the rank of the different cultivars was almost similar in the eight environments. This could be supported by the correlation matrix between grain yields at the eight environments summarized in Table (7). All the correlation coefficients were highly significant and their values ranged between 0.883 to 0.988. This would indicate that cultivar rank was consistent at the eight environments. In the future one regime would be enough to predict the yield potentiality of the different cultivars. The significant interaction might be due to magnitude of the differences between the cultivars rather than their rank. The difference between the highest and lowest yielding cultivars was 3.50 t/ha in regime 1 in 1996 while it reached 7.24 (t/ha) for regime 4 in 1996. This would suggest that regime 4 (60,000 plants/ha + 300 kg N/ha) would be recommended for the evaluation of the cultivars for both the high and low productive level.

Table (7): Correlation coefficients among the yield of grain (t/ha) of the 16 cultivars at the eight environments.

Character	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
Y_1 Regime 1, 1996	0.964	0.964	0.971	0.991	0.953	0.977	0.936
Y_2 Regime 2, 1996		0.937	0.936	0.960	0.958	0.939	0.957
Y_3 Regime 3, 1996			0.988	0.976	0.962	0.986	0.869
Y_4 Regime 4, 1996				0.981	09.975	0.987	0.873
Y_5 Regime 1, 1997					0.965	0.986	0.923
Y_6 Regime 2, 1997						0.960	0.883
Y_7 Regime 3, 1997							0.904
Y_8 Regime 4, 1997							

*** All the correlation coefficients are significant from zero at the 0.01 level of probability.**

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استجابة أصناف الذرة الشامية لنظم رعاية مختلفة

محمد عبد الستار أحمد و محمد حسن الشيخ
قسم المحاصيل – كلية الزراعة – الشاطبى - جامعة الاسكندرية

أجريت تجربتان حقليتان بمحطة البحوث الزراعية – جامعة الاسكندرية خلال موسمى صيف 1996، 1997. واشتملت كل تجربة على 16 صنفا من الذرة الشامية منها ثمانية هجن فردية وسبعة هجن ثلاثية وصنف واحد تركيبى مفتوح التلقيح.

وقد تم تقييم هذه الاصناف تحت أربعة نظم للرعاية (40 الف نبات + 150 كجم أزوت/هكتار، 60 ألف نبات + 150 كجم أزوت/هكتار، 40 ألف نبات + 30 كجم أزوت/هكتار، 60 الف نبات + 300 كجم أزوت/هكتار). وتم استخدام تصميم القطع المنشقة مرة واحدة فى ثلاث مكررات. ويمكن تلخيص أهم النتائج فيما يلى:

1- أوضحت النتائج المتحصل عليها ان تأثير نظم الرعاية كان عالى المعنوية على محصول الحبوب ومعظم مكوناته واعطى نظام الرعاية (60 الف نبات + 300 كجم ازوت /هكتار) أعلى محصول للحبوب بمتوسط قدره 9.33 طن / هكتار فى الموسمين بالمقارنة بمتوسط 4.47 طن /هكتار لأقل نظام للرعاية (40 الف نبات + 150 كجم ازوت / هكتار). أما النظامان الآخران فقد كان محصول الحبوب فيهما متوسطا. وقد يرجع اعلى محصول للحبوب من النظام (60 الف نبات + 300 كجم أزوت / هكتار)أساسا الى زيادة عدد النباتات فى الهكتار، حيث بلغت عند الحصاد حوالى 150% بالمقارنة بالعشيرة المكونة من 40 ألف نبات / هكتار. ووجد أن هذه الزيادة فى عدد النباتات كانت مرتبطة بالنقص الطفيف فى مكونات المحصول وهى عدد الكيزان /نبات ووزن المائة حبه وحجم الكوز (الطول X القطر).

2- اتضح من هذه الدراسة ان الهجين الفردى "10" تميز بالثبات فى التفوق فى الانتاجية خلال الموسمين، بينما تذبذبت الانتاجية فى كل من الهجن الفردية الأخرى المرتفعة المحصول مثل بشاير 13 وهجين فردى 124 وهجين فردى 129 خلال الموسمين. كما تميزت الهجن المتفوقه فى الانتاجية بثقل وزن الحبوب وكبر حجم الكيزان (الطول X القطر).

3- على الرغم من وجود تفاعل معنوى بين الاصناف ونظم الانتاجية الأربعة لم يؤثر هذا التفاعل على ترتيب الاصناف. وقد تراوح معامل الارتباط بين قيم محصول الحبوب عند البيئات الثمانية ما بين 0.883 و 0.987 وكان معنويا جدا عن الصفر. وهذا يوضح أن ترتيب الصنف كان ثابتا على مدى البيئات الثمانية التى استخدمت خلال عامى الدراسة. وفى المستقبل قد يكون استخدام نظام واحد للرعاية كافيا لإستنتاج القدرة المحصولية للاصناف المختلفة.ومعنوية التفاعل هنا ربما ترجع الى حجم الفرق بين الاصناف وليست لترتيب الاصناف بحسب انتاجيتها داخل أى من نظم الرعاية (البيئات).

4- توضح نتائج الدراسة الحالية أن نظام الرعاية الرابع (60.000 نبات + 300 كجم أزوت / هكتار) قد يمكن التوصية به لتقييم الاصناف من حيث الانتاجية.

Table (1): Analysis of variance for grain yield and its components of maize cultivars under four management regimes in 1996 and 1997 seasons.

S.O.V.	d.f.	Grain yield (t/ha)		No. of ears/plant		Ear length (cm)		Ear diameter (cm)		100-kernel weight (g)	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Replications	2	0.005	0.089	0.005	0.002	0.001	0.024	0.004	0.013	0.018	0.012
Managements (M)	3	239.53**	166.18**	0.262**	0.204**	4.065**	0.150**	0.063**	0.103**	42.420**	0.323
Error (a)	6	0.011	0.022	0.006	0.001	0.004	0.028	0.006	0.020	0.065	0.041
Cultivars (C)	15	21.325**	17.293**	0.002**	0.006**	9.743**	6.233**	0.280**	0.258**	16.734**	16.829**
C x M	45	0.693**	0.508**	0.002**	0.001	0.210**	0.067	0.005	0.023**	9.484**	0.160
Error (b)	120	0.004	0.021	0.002	0.002	0.015	0.480	0.005	0.013	0.030	0.192

**** indicates significance at 0.01 level of probability.**

Table (2): Means of grain yield, yield components and some agronomic characters for the four management regimes in 1996 and 1997 seasons.

Management regimes	Grain yield (t/ha)		No. of ears/plant		Ear length (cm)		Ear diameter (cm)		100-kernel weight(g)		Silking date (days)		Plant height (cm)		Ear height (cm)	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
40 M^1 + 150 N^2	4.417d	4.516d	1.19a	1.18a	18.72a	18.80a	4.54a	4.58b	29.38b	29.34ab	58.48a	59.27a	218.10d	214.94b	100.98c	97.23b
60 M^1 + 150 N^2	7.729b	7.368b	1.05b	1.06c	18.21c	18.72b	4.52a	4.58b	28.03c	29.42a	58.56a	59.02a	232.22a	217.67a	106.42a	99.77a
40 M^1 + 300 N^2	6.414c	6.245c	1.15a	1.16b	18.28b	18.79a	4.55a	4.66a	29.89a	29.26b	58.40a	59.12a	219.25c	213.40b	99.75d	98.35b
60 M^1 + 300 N^2	9.728a	8.931a	1.04b	1.05c	18.03d	18.69b	4.46b	4.66a	28.07c	29.24b	58.19a	59.08a	229.08b	219.17a	105.60b	102.58a
Overall means	7.072	6.765	1.11	1.11	18.31	18.75	4.52	4.62	28.84	29.32	58.41	59.12	224.66	216.30	103.19	99.48

Means followed by a common letter are not significantly different according to the L.S.D test.
M^1 = 1000 plants/ha. N^2 = kg nitrogen/ha.

Table (4): Means of grain yield and its components of different cultivars averaged over the four management regimes in 1996 and 1997 seasons.

Serial number	Cultivar	Grain yield (t/ha)		No. of ears/plant		Ear length (cm)		Ear diameter (cm)		100-kernel weight (g)	
		1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
1	S.C. 9	7.275 f	7.058 e	1.09 bcde	1.10 bc	18.87 c	18.75 def	4.60 b	4.62 def	29.30 c	29.33 d
2	S.C. 10	9.821 a	9.571 a	1.14 a	1.13 a	20.06 a	20.25 a	4.83 a	4.93 a	32.05 a	32.13 a
3	B.C. Bachear 13	8.542 b	8.438 b	1.08 e	1.10 bc	19.85 b	19.64 b	4.79 a	4.76 b	30.28 b	31.16 b
4	S.C. 122	7.643 d	7.108 e	1.09 bcde	1.13 a	18.15 e	18.39 g	4.43 fg	4.47 g	28.19 g	28.32 g
5	S.C. 123	7.617 de	7.154 e	1.12 abc	1.13 a	18.10 e	18.43 g	4.43 fg	4.54 fg	28.25 g	28.3s4 g
6	S.C. 124	8.583 b	7.583 d	1.12 abc	1.11 abc	18.93 c	18.96 c	4.61 b	4.72 bc	29.21 c	29.29 d
7	S.C. 129	8.458 c	7.750 c	1.12 abc	1.11 abc	18.91 c	18.96 c	4.62 b	4.74 b	29.28 c	29.88 c
8	Watinia 4	7.575 e	7.079 e	1.12 abc	1.10 bc	18.37 d	18.63 f	4.53 c	4.56 ef	28.79 d	28.91 ef
9	T.W.C. 310	6.083 ij	6.096 g	1.10 bcde	1.12 ab	18.10 e	18.90 cd	4.48 cdef	4.62 def	28.72 d	29.38 d
10	T.W.C. 320	6.196 h	5.913 hi	1.09 bcde	1.12 ab	18.14 e	18.81 cde	4.49 cde	4.62 def	28.68 de	29.30 d
11	T.W.C. 321	6.396 g	6.313 f	1.12 abc	1.11 abc	18.16 e	18.75 def	4.46 defg	4.65 cd	28.74 d	29.38 d
12	T.W.C. 322	6.133 i	5.938 h	1.11 bcd	1.12 ab	17.97 f	18.71 ef	4.42 g	4.62 def	28.58 ef	29.55 cd
13	T.W.C. 323	6.038 ij	5.804 ij	1.10 bcde	1.13 a	17.71 g	18.73 def	4.49 cde	4.62 def	28.47 f	29.38 d
14	T.W.C. 324	6.100 i	5.950 h	1.10 bcde	1.10 bc	17.72 g	18.73 def	4.44 efg	4.61 def	28.51 f	29.20 de
15	Watinia 4	5.963 k	5.770 ij	1.09 bcde	1.12 ab	17.71 g	18.65 ef	4.50 cd	4.63 de	28.13 g	28.84 f
16	Alex.-4	4.729 l	4.713 k	1.11 bcd	1.14 a	16.23 h	16.66 h	4.18 h	4.23 h	26.32 h	26.67 h
Overall mean		7.072	6.765	1.11	1.12	18.31	18.75	4.52	4.62	28.84	29.32

Means followed by a common letter(s) are not significantly different according to the L.S.D (0.05) test.

Table (5): Means of some agronomic characters for different maize cultivars averaged over the four management regimes in 1996 and 1997 seasons.

Serial number	Cultivar	Silking date (days)		Plant height (cm)		Ear height (cm)	
		1996	1997	1996	1997	1996	1997
1	S.C. 9	58.50 cd	59.50 cd	237.83 c	228.17 c	106.92 e	103.83 c
2	S.C. 10	59.58 a	60.16 ab	252.75 a	239.17 a	118.92 a	113.58 a
3	B.C. Bachear 13	59.25 ab	60.50 a	249.33 b	236.17 b	116.67 b	112.33 ab
4	S.C. 122	58.50 cd	59.50 cd	202.33 i	192.42 l	99.33 gh	94.58 d
5	S.C. 123	58.42 cde	59.75 bc	202.67 i	194.83 l	99.08 h	103.92 c
6	S.C. 124	58.75 c	59.25 de	238.42 c	225.17 d	110.08 d	105.75 c
7	S.C. 129	58.58 cd	59.58 cd	238.08 c	227.92 c	111.92 c	107.00 bc
8	Watinia 4	58.75 c	59.25 de	234.67 d	220.83 e	107.92 e	103.08 c
9	T.W.C. 310	57.92 f	59.00 ef	218.25 f	213.25 h	99.83 fgh	95.92 d
10	T.W.C. 320	57.83 f	58.91 efg	219.17 ef	214.92 g	100.58 f	94.92 d
11	T.W.C. 321	58.25 def	58.58 fgh	220.25 e	217.00 f	100.00 fgh	96.08 d
12	T.W.C. 322	57.92 f	59.00 ef	218.67 f	213.33 gh	99.50 fgh	94.83 d
13	T.W.C. 323	58.25 def	58.50 gh	219.25 ef	212.83 hi	100.42 fg	94.58 d
14	T.W.C. 324	58.00 ef	58.91 efg	219.00 ef	211.08 ij	99.00 h	94.50 d
15	Watinia 4	58.83 bc	58.25 h	216.75 g	210.83 j	99.00 h	92.75 d
16	Alex.-4	57.17 g	57.33 i	207.25 h	204.75 k	81.83 i	84.08 e
Overall mean		58.53	59.12	224.67	216.42	103.19	99.48

Means followed by a common letter(s) are not significantly different according to the L.S.D (0.05) test.

Table (6): Mean yield (t/ha) of the different cultivars under the four management regimes and their rank (between parenthesis) in 1996 and 1997 seasons.

Serial number	Cultivar	Regime 1		Regime 2		Regime 3		Regime 4	
		1996	1997	1996	1997	1996	1997	1996	1997
1	S.C. 9	4.38 (8)	4.79 (5)	8.37 (7)	7.52 (8)	6.52 (8)	6.85 (8)	9.83 (8)	8.90 (6)
2	S.C. 10	6.52 (1)	6.63 (1)	10.48 (1)	9.93 (1)	8.67 (1)	8.88 (1)	13.62 (1)	12.83 (1)
3	B.C. Bachear 13	5.50 (2)	5.93 (2)	9.65 (2)	9.07 (2)	7.52 (3)	8.13 (2)	11.50 (3)	10.62 (2)
4	S.C. 122	4.60 (5)	4.60 (6)	8.63 (5)	8.07 (7)	6.64 (7)	6.93 (5)	10.70 (5)	8.83 (7)
5	S.C. 123	4.52 (7)	4.57 (7)	8.55 (6)	8.18 (6)	6.80 (5)	6.87 (6)	10.60 (7)	9.00 (5)
6	S.C. 124	5.47 (3)	5.10 (3)	9.62 (3)	8.78 (4)	7.45 (4)	7.03 (4)	11.80 (2)	9.42 (4)
7	S.C. 129	5.45 (4)	5.03 (4)	9.40 (4)	8.87 (3)	7.57 (2)	7.32 (3)	11.42 (4)	9.78 (3)
8	Watinia 4	4.57 (6)	4.55 (8)	8.32 (8)	8.20 (5)	6.73 (6)	6.87 (6)	10.68 (6)	8.70 (9)
9	T.W.C. 310	3.93 (10)	4.07 (11)	6.52 (12)	6.62 (10)	5.60 (13)	5.47 (10)	8.28 (15)	8.23 (13)
10	T.W.C. 320	3.85 (11)	4.10 (10)	6.63 (10)	6.35 (12)	5.90 (10)	5.10 (12)	8.40 (13)	8.10 (15)
11	T.W.C. 321	4.10 (9)	4.23 (9)	6.75 (9)	6.63 (9)	6.05 (9)	5.67 (9)	8.68 (9)	8.72 (8)
12	T.W.C. 322	3.82 (12)	3.90 (13)	6.55 (11)	6.13 (13)	6.79 (11)	5.22 (11)	8.47 (11)	8.50 (10)
13	T.W.C. 323	3.73 (14)	3.83 (14)	6.45 (14)	6.07 (15)	5.55 (15)	5.02 (14)	8.42 (12)	8.30 (12)
14	T.W.C. 324	3.77 (13)	3.93 (12)	6.52 (12)	6.40 (11)	5.62 (12)	5.07 (13)	8.50 (10)	8.40 (11)
15	Watinia 4	3.57 (15)	3.78 (15)	6.35 (15)	6.10 (14)	5.57 (14)	4.97 (15)	8.37 (14)	8.23 (13)
16	Alex.-4	2.90 (16)	3.02 (16)	4.52 (16)	4.97 (16)	4.75 (16)	4.53 (16)	6.38 (16)	6.33 (16)
$L.S.D_{0.05}$		0.10	0.24	0.10	0.24	0.10	0.24	0.10	0.24

Means followed by a common letter(s) are not significantly different according to the L.S.D (0.05) test.