

## Response of Some Corn Hybrids To Splitting Nitrogen Fertilizer

Zainb A.M. Moharram, El-Saiyd M.M. Shalaby, El-Mahdi A.Teama and Abdel-Hakem.Y. Allam

Dept. Agron., Fac. Agric., Assiut Univ., Assiut, Egypt.

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### Abstract:

This research is concerned with studying the response of four corn hybrids, two yellow and two white represent the single and three-way hybrids to splitting nitrogen. The study was carried out in Assiut University Experimental Farm during 2008 and 2009 seasons. The design of the experiment was split plot in which the hybrids was in the main plots and splitting nitrogen in the sub plots.

The results obtained proved that the single cross hybrids surpassed the three-way ones in both vegetative attributes and grain yield & its components in the two growing seasons. Partitioning nitrogen into four doses favoured vegetative & yield attributes. All involved interactions between nitrogen x hybrids were significant indicating that the three-way hybrids showed considerable responses to nitrogen splitting treatments as compared with the single ones.

**Key words:** hybrids, nitrogen splitting.

### Introduction

Nitrogen fertilization is essential for profitable corn production. It is also a major cost of production. The Egyptian growers used to apply great amount of N fertilizer. This is due to the

surface irrigation which contributes in leaching. Here, also, the existence of some sodium salts which change percentage of nitrogen to ammonia which easy lost. Therefore, the present study aimed to partitionate nitrogen into different doses as a method to improve nitrogen management.

The response of such treatments on corn hybrids was early investigated by Sharaan *et al.* (2002), El-Shenawy (2003), Mowafy (2003), El-Aref *et al.* (2004) and Oraby *et al.* (2005). They reported found that genotypic variation was observed among hybrids in favour of single cross ones. Rizwan *et al.* (2003), Sholtanyuk and Nadochaev (2004) and Muthukumar *et al.* (2005) showed that split nitrogen favoured grain yield and protein.

### Materials and Methods

The present research is concerned with studying the response of four hybrids, i.e. two yellow and two white to nitrogen splitting treatments. This study was carried out at Assiut University Experimental Farm during the summer seasons of 2008 and 2009 to study the response of four corn hybrids to nitrogen splitting application under Assiut

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conditions. The preceding crop was Egyptian clover in both seasons. The mechanical and chemi-

cal analyses of the soil of the experimental sites are presented in table (1)

Table(1):Some physical and chemical properties of experimental sites:

Properties	2008	2009
<b>Mechanical analysis</b>		
Sand	26.20	26.60
Silt	24.20	23.00
Clay	49.60	50.40
Soil type	Clay	Clay
<b>Chemical analysis</b>		
pH	7.73	7.80
Organic matter %	1.74	1.62
Total N %	0.08	0.07
Total CaCO <sub>3</sub> %	1.17	1.20

A randomized complete block design in a split plot arrangement with four replicates was used. Four hybrids of maize namely; white single cross Watania (V1), yellow single cross shams (V2), white three-way 310 (V3) and yellow three-way (V4) were obtained from the Agricul-

ture Research Center and used for this work. The four hybrids were assigned to the main plots. The different four nitrogen splitting treatments occupied the sub plots at the recommended dose (120 kg N/fed.). The distribution was as follows in the two growing seasons (Table 2).

Table (2): Distribution of splitting nitrogen through two seasons.

Application time Nitrogen (kg/fed.)	The first irrigation	The second irrigation	The third irrigation	The fourth irrigation	Total amount
N <sub>1</sub>	60	60	-	-	120
N <sub>2</sub>	40	40	40	-	120
N <sub>3</sub>	20	20	40	40	120
N <sub>4</sub>	0	40	40	40	120

The grains were sown in the 4<sup>th</sup> of June and 10<sup>th</sup> of July in the first and second seasons, respectively in plots composed of 5 ridges (0.7 meter in width and 3.00 meters in length). Grains were sown in hills 30 cm about.

The area of each plot was 10.5 m<sup>2</sup> (1/400 feddan). Hills were thinned after complete emergence before the 1<sup>st</sup> irrigation leaving one plant per hill.

Other cultural practices were carried out as recommended

throughout the two growing seasons.

**Data recorded at harvest:**

At harvest, random samples of five guarded plants were taken from each sub plot to estimate the following traits:

**A) Vegetative traits:**

- 1- Plant height (cm).
- 2- Ear height (cm)
- 3- Average number of total leaves/plant.
- 4- Average number of green leaves/plant.

**B) Yield and its components:**

- 1- Ear length (cm).
- 2- Ear diameter (cm).
- 3- Number of rows/ear
- 4- Number of grains/row
- 5- 100-grain weight (g).
- 6- Grain Shelling percentage.  
$$\text{Grain Shelling \%} = \frac{\text{Grains weight}}{\text{Ears weight}} \times 100$$
- 7- Grain yield /feddan in ardab (1 ardab =140 kg) was estimated based on grain yield /plot.

**C) Protein percentage:**

Protein percentage in grains was determined in random sample drawn from each sub plot using the technique of micro-kjeldahle apparatus according to A.O.A.C. (1980). The determined nitrogen contents were then multiplied by 6.25 to calculate protein % in the grains.

**Statistical analysis:**

Statistical analysis of the collected data was carried out using the computer program MSTAT-C statistical analysis package by Freed *et al.* (1989) according to Gomez and Gomez (1984). Bartlett test was used to assess the variance of experimental error of both seasons. It showed that

combined analysis could not be used. Thus, each season's data was statistically analyzed and presented separately. Least significant difference (L.S.D. 0.05) was used for comparison among the means.

**Results and Discussion :**

The obtained results will be presented and discussed here under the following sub-headings.

Vegetative traits attributes, grain yield & its components and grain quality:

**A – Vegetative traits:**

The results reported in Tables (2 and 3) indicated that the studied vegetative traits reacted significantly to the studied corn hybrids in favour of single cross hybrids. This was true in the two growing seasons. This trend could be ascribed to the higher hybrid vigour of the single cross hybrids as compared with the three-way ones. However, slight increases in vegetative traits of white hybrids as compared with yellow ones which may be attributed to the genetic variation among them. The present results agreed with those obtained by Hasan and Gaballah (1999), Ata Allah *et al.* (2002), Sharaan *et al.* (2002). However, Ahmed (2004) found that the three-way cultivar 310 gave the maximum values in plant and ear height compared with other genotypes such as single cross (SE 10) and open-pollinated varieties.

Nitrogen splitting affected significantly the studied vegetative traits as shown in Tables (3 and 4). The obtained results re-

vealed that partitioning the recommended dose of nitrogen (120 kg/fed.) into four doses favoured the vegetative traits as compared with the other treatments. The amount and time of N<sub>3</sub> nitrogen application were 20, 20, 40 and 40 kg N/fed. applied before, the first, second, third and fourth irrigations, respectively. The present trend hold fairly true in the two growing seasons. Thus, it is clear that splitting the recommended dose of nitrogen into four times, i.e. at different stages of growth is very important. This in turn may lead the plants to face the different requirements of nitrogen at different stages of growth. This could maximize the benefit of nitrogen. Therefore, the present results are in harmony with those obtained by Mahfouz and Ghabour (1998), Ata Allah *et*

*al.* (2002), Sharaan *et al.* (2002), Mowafy (2003), Rizwan *et al.* (2003), Ash Shormillesy (2005), Khun *et al.* (2006), Zeidan *et al.* (2006) and Kostandi and Soliman (2008). However, Ferreira *et al.* (2000), in Brazil, revealed that splitting nitrogen had no significant effect on the maize height ear.

Regarding the interaction involved, the data obtained in this respect declared that the first order interaction of corn hybrids x nitrogen splitting turned to be significant for all the studied vegetative traits. The interaction revealed that the triple hybrids responded more to the nitrogen splitting as compared with the single ones. This could be attributed to the broad genetic base of such hybrids as compared with the single cross ones.





### **B- Grain yield and its attributes:**

The results illustrated in Tables (5, 6 and 7) revealed that average grain yield of corn was reacted significantly to the studied hybrids in favour of single cross varieties. The average grain yields were 21.59, 20.60, 17.81 and 17.38 ardab/fed. in 2008 season for the hybrids white single cross, wania & yellow single cross Shams white, three-way cross 310 and yellow three-way 351, respectively. The corresponding averages, in 2009 season were 22.15, 21.72, 18.91 and 18.31 ardab/fed. in the same order. The present results are to be expected since the yield attributes such as number of rows/ear, number of kernels/ear, seed index, shelling percentage, ear length and diameter took the same trends as shown in the above tables. These results proved that the higher hybrid vigour of the single cross varieties if there are no stresses to be faced may be the main cause of this trend. The present trend was confirmed with those obtained by El-Bana (2001), Sharaan *et al.* (2002), El-Shenawy (2003), Mowafy (2003), Mohamed (2004), Oraby *et al.* (2005) and Saleem *et al.* (2009).

Regarding partitioning of nitrogen the data demonstrated in Tables (5, 6 and 7) revealed clearly significant reactions for corn grain yield and its components for this trial. The data

proved that partitioning nitrogen into four doses favoured yield components and consequently grain yield/fed. The grain yields in 2008 amounted to 17.19, 17.98, 22.63 and 19.58 ardab/feddan for the doses 20, 20, 40 and 40 kg N/fed. for the treatments N<sub>1</sub>, N<sub>2</sub>, N<sub>3</sub> and N<sub>4</sub>, respectively. The corresponding yields in 2009 were 18.08, 18.94, 22.52 and 21.56 ardab/fed. in the same order. However the lowest grain yields were obtained from applying nitrogen into two doses. The first dose, i.e. 60 kg nitrogen before the first irrigation and the rest before the second one (the recommended treatment). Therefore the results revealed the importance of applying nitrogen at different stages of growth to face the different requirements of each stage. The present trend could be ascribed to one or more of the following:

- 1- Splitting nitrogen may decrease the rate of leaching.
- 2- Splitting nitrogen is very important to face the different requirements of corn in different stages of growth. This could maximize the benefit of nitrogen.
- 3- The Egyptian soil tended to be alkali to the presence of calcium carbonate. This may change the majority of added nitrogen into ammonia which easily lost. Then splitting nitrogen may avoid that loss. Here it should be noted that the vegetative traits and yield components as mentioned before responded well to nitrogen splitting. This could be attributed to

the low nitrogen of the experimental soil (Table 1).

Therefore the response of corn grain yield to splitting nitrogen was the result of such traits. The present results are in harmony with those obtained by Hendrickson and Han (2000), Palled and Shenoy (2000), Grosso *et al.* (2002), Mowafy (2003), Rizwan *et al.* (2003), Silva and Silva (2003), Sholtanyuk and Nadtochaev (2004) and Osman (2006). On the other hand, Souza *et al.* (2001) found that application time as well as nitrogen splitting did not show distinguishes increase in maize grain yield. This discrepancy may be due to the different degrees of the soils fertility studied.

Here too, all the interactions involved, i.e. hybrids x splitting nitrogen for grain yield and its

attributes were significant among the two growing seasons. They revealed that the three-way hybrids showed pronounce responses to nitrogen splitting when compared to single ones. This may be attributed to the broad genetic base of such hybrids as compared to single ones.

#### **C- Protein percentage:**

The present trait seemed to be reacted significantly to the type of hybrids studied (Table 8). The single-hybrids were characterized with high percentage of protein, than the three-way ones. Here too, the white hybrids surpassed the yellow ones. This trend could be due to the genetic variation between the two hybrids. In this respect Ahmed (2004) found that open pollinated variety had









the highest protein content in grains compared with SC10 and TWC 310. However, Azeez *et al.* (2005), in Nigeria, showed that genotypic variation observed in the maize agronomic traits were not significant exception leaf weight and grain yield.

The data obtained in Table (8) showed that splitting nitrogen had a significant effect on protein percentage in favour of (N<sub>3</sub>) in the two growing seasons. This means that splitting the recommended nitrogen rate (120 kg N/fed.) into four doses, i.e. 20, 20, 40 and 40 kg N/fed. before the first, the second, third and fourth irrigation, respectively gave the maximum percentage of protein in corn grains. The present trend is to be expected since corn plants were faced by its requirements of nitrogen during the different stages of growth. This trend was confirmed by those obtained by Lu-WeiPing *et al.* (1999) and Thomison *et al.* (2004). The interaction between hybrids x splitting of nitrogen was significant in the two growing seasons. It revealed that the degree of response to nitrogen splitting was higher for single-cross hybrids as compared with the three-way ones.

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استجابة بعض هجن الذرة الشامية إلى تجزئة السماد الأزوتي  
زينب أحمد محمد محرم ، السيد محمود شلبي ، المهدي عبدالمطلب طعيمة ،  
عبدالحاكم يونس علام

قسم المحاصيل – كلية الزراعة – جامعة أسيوط

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يختص هذا البحث بدراسة استجابة أربعة هجن ذرة شامية منهم هجين فردي أبيض والأخر أصفر ، كذلك هجين ثلاثي أبيض وآخر أصفر إلى تجزئة السماد الأزوتي الموصي به وهو 120 كجم/ فدان إلى تقسيمات عديدة ، ولقد أجريت الدراسة خلال موسمي 2008 ، 2009 بمحطة التجارب الزراعية بكلية الزراعة جامعة أسيوط ، ولقد كان التصميم المتبع هو القطع المنشقة حيث كانت الهجن في القطع الرئيسية ، وتجزئة النيتروجين في القطع المنشقة. ولقد كانت التجزئة في خمس معاملات طبقاً للجدول التالي :

كمية الأزوت (كجم/فدان)	قبل رية المحيايه	قبل الريه الثانية	قبل الريه الثالثة	قبل الريه الرابعة	مجموع الجرعات (كجم/فدان)
المعاملة الأولى	60	60	-	-	120
المعاملة الثانية	40	40	40	-	120
المعاملة الثالثة	20	20	40	40	120
المعاملة الرابعة	صفر	40	40	40	120

وقد أوضحت النتائج تفوق الهجن الفردية عن الهجن الثلاثية في صفات النمو الخضري من طول النبات وعدد الأوراق الخضراء وموقع الكوز على الساق ، كما تفوق حاصل الحبوب ومكوناته في الهجن الفردية عن الهجن الثلاثية .  
أما فيما يختص بتجزئة السماد الأزوتي فقد كان تأثيره فعال في تفوق الصفات الخضرية وزيادة حاصل الحبوب ومكوناته كما كان له تأثير كبير على زيادة نسبة البروتين في حبوب الذرة الشامية وبالنسبة للتفاعلات فقد كان التفاعل بين الهجن x تجزئة النيتروجين تأثير معنوي لمعظم الصفات المدروسة حيث كانت استجابة الهجن الثلاثية لتجزئة السماد أكبر من الهجن الفردية ويرجع ذلك إلى أن التركيب الوراثي للهجن الثلاثة أشمل وأعرض من الهجن الفردية.