EFFECT OF SOME FERTILIZER REGIMES ON PRODUCTIVITY, QUALITY AND TORABILITYOF SWEET CORN

BY

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B. Sc. Agric. Cooperation, High Institute of Agric. Co-operation, Shoubra El-Kheima, 1995

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ABSTRACT

Saleh Mohamed Abou El-Wafa. Effect of some Fertilizer Regimes on Productivity, Quality and Storability of Sweet Corn. Unpublished M.Sc. Thesis, Ain Shams University, Faculty of Agriculture, Department of Horticulture, 2006.

This study was conducted at Ali Mubarak Village Research Farm, South Tahrir Horticulture Research Station, Beheirah Governorate and the Department of Vegetable Handling and Post Harvest Researches during the fall seasons of 2002/2003 and 2003/2004 in the field and laboratory experiments. The purpose of the field experiment was to study the effect of nitrogen fertilization level with drip irrigation viz., 100, 120, 140 and 160 kg nitrogen per fed. and calcium foliar application, viz., 0 , 500 and 1000 ppm on vegetative growth, ear characters and yield of sugary sweet corn hybrid Jubille under the condition of sandy soil. The results showed that increasing nitrogen fertilization levels and calcium foliar applications significantly increased vegetative growth (plant height, plant diameter, leaf area, plant fresh and dry weights), ear characters and yield (ear length, ear diameter, number of kernel along ear, number of kernels /row, un-husked and husked ear weight, fresh and dry weight of 1000 kernel and total yield per fed.) in both seasons. The laboratory experiment included the best treatment, which selected from the field experiment as follows (160kg nitrogen per fed. with 1000-ppm calcium), as well as using three wrapping films, i.e., unwrapped, stretch film of 0.09 micron thickness, polypropylene film of 20 micron thickness and storage periods on storability, sugar composition and physical and chemical characters during storage and shelf life of sweet corn ears. The results showed that loss in weight, denting, discoloration for cut end ,dry matter percent and decay increased with extending the storage period.

While visual quality, tasting, TSS and free sugars were decreased with the time during storage. Concerning effect of wrapping types, the results showed also that weight loss between wrapping and unwrapped whereas, polypropylene film and stretch film gave the lowest weight loss (%) while unwrapped gave highest weight loss (%)during the storage periods. Wrapping and unwrapped showed significant differences in dry matter, visual quality, denting, discoloration, TSS, decay, and free sugars.

Key words: Sweet corn, Fertilization, Yield quality, Storability.

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1-INTRODUCTION

Sweet corn **(*Zea mays,* L. var. *rugosa*)** is a mutation of maize and it is one of the most popular vegetables in the world and its popularity is increasing in Asia and Europe which is distinguished from other corns by its high sugar content in the milky stage and by its wrinkled and use as a fresh, frozen and canned form. In Egypt, sweet corn is considered as an important exportable crop in the future.

Little information are available on sweet corn in Egypt, especially in the newly reclaimed sandy soils. Sweet corn plant is highly sensitive to nitrogen fertilization particularly during the early stages of growth.

Also, it is newly introduced to the Egypt and the information on the pre- and post-harvest behavior of sweet corn under Egyptian conditions is scarce. Calcium nutrition faced problem sometimes in fixation or unavailability in the Egyptian alkaline soils and it plays an important function for increasing fruit quality pre-harvest as well as post- harvest. Moreover, sweet corn is one of the most perishable vegetables, it has very high respiration rate. The sugar content which largely determines quality, decreases rapidly at room temperature. Thus, minimum safe low temperature is (0˚C). In addition, film wraps can be beneficial in maintaining high relative humidity, creating a modified atmosphere packaging (MAP) involves changing in oxygen/carbon dioxide ratio are essential to maximize shelf life and to minimize quality losses.

Therefore, the present study aimed to study the effect of nitrogen fertilization rates and calcium foliar application on yield and quality. In addition, some methods of keeping quality and enhancing the storability after harvesting were, also, investigated.

2- Review of literature

In order to have a wide view on the subject of ‘‘ Effect of some fertilizer regimes on productivity, quality and storability of sweet corn ”, the review of literature could be subdivided under the following topics:

(1) Effect of nitrogen fertigation levels and calcium foliar application on vegetative growth
(2) Effect of nitrogen fertigation levels and calcium foliar application on ear characteristics
(3) Effect of nitrogen fertigation levels and calcium foliar application on chemical components
(4) Effect of nitrogen fertigation levels and calcium foliar application on chemical analysis
(5) Effect of storage treatments

2-1 Effect of Nitrogen Fertigation Levels and Calcium Foliar Application on Vegetative Growth

2-1-1 Plant height , stem diameter and leaf area

Moursi *et al.* (1983), Gomaa (1985) and Mohamed (1985), **Khedr (1986)**, **Abd El-Aziz (1987), Hassan (1995), El-Habbak and Shams El-Din (1996), Lamloum (1997), El-Far (2000), El-Ganayni (2000), El-Bana (2001) and Soliman *et al.* (2001)** reported that increasing nitrogen fertilization levels up to 120 Kg N/ fed. led to increases in leaf area index (LAI), plant height and stem diameter in maize plants. On the other hand**, Dawood *et al.* (1992)**, **Nawar *et al.* (1992), Shafshak *et al.* (1994), Awad *et al.* (1994), Younis *et al.* (1995), Selim and Gouda (1998), Mullins *et al.* (1999), El-Agamy *et al.* (1999), El-Bana and Gomaa (2000), El-Hassanin *et al.* (2002), Nofal and Salem (2003), Oraby *et al.* (2003), Grazia *et al.* (2003) and Hassan (2004)** reported that increasing nitrogen fertilization levels up to 130 - 150 Kg N/ fed.

led to increases in leaf area index (LAI), plant height and stem diameter in sweet corn and maize plants.

Hons and Aljoe (1985) observed that the addition of Ca at the rate of (0, 42 and 84), mg Ca/Kg soil, 5 weeks after emergence of sweet corn plants increased plant height and leaf area.

Hunter *et al.* (1995) observed that application of $CaCo_3$ rates (0-5 and 10 Mg/ha) and green manure rats(7.5 and 15Mg/ha), led to increasing vegetative growth characters in sweet corn plants.

Abd El-Razik and Ghoneim (1999) revealed that leaf area/plant as well as plant height of sweet corn were progressively and constantly increased with the increment of N levels up to 105 kg N/fed. However, the highest N rates (70 and 105 kg N/fed.) were insignificantly differed in regard to leaf area/plant during the first season and plant height in the second season.

Navarro *et al.* (1999) mentioned that increasing Ca level from 2 to 8Mm in the nutrient solution, used for the nutrient of melon plants (cv. Galia) grown hydroponically in greenhouse under saline condition (Nacl at 80 mM), improved the vegetative growth to the same extent of growing these at 10Mm of NacL.

Abd El-Hady (2001) found that under conditions of sandy soil, length of cantaloupe plants was obviously governed by Ca concentration in the foliar spray solution. The tallest plants were obtained by spraying cantaloupe plant with 0.22 g/L**.**

2-1-2 Plant fresh and dry weight

English and Maynard (1981) found that increasing Ca concentration in nutrient solution increased plant dry weight. This was true in 53 tomato strains under the condition of this study.

Taylor *et al.* (1985) found that when plants of some vegetable were supplied with additional Ca, in presence of NH4-N, fresh weight of aerial parts was increased by 27.2% in squash, 250% in tomato, 148% in cabbage 14.5% in radish, 13.3% in chili pepper and 21.5% in Swiss chard**.**

Salardini *et al.* (1992) found that the highest fresh shoots (93.8) t/ha and the highest concentration of N in cobs and shoot dry matter (DM) were attained with increasing N application

Padmaja *et al.* (1999) showed that grain and Stover yields increased linearly with increasing N rate (0-50-100 and 150 kg/ha.)

Hassan (2004) stated that increasing nitrogen fertilization levels from 0 to 180 kg N/ fed. led to increasing the total dry weight per plant in both growing seasons.

2-2 Effect of Nitrogen Fertigation Levels and Calcium Foliar Application on Ear Characteristic

2-2-1 Ear length, ear diameter and number of rows/ear.

Smith (1984) stated that limes applied from(cacitic, cacitic with3%Mg and dolomitic (12% Mg) during growth led to increasing ear length of sweet corn plants.

Younis (1985) mentioned that increasing nitrogen fertilizer levels up to 90 kg N/fed. increased ear length, ear diameter and number of grains/row.

Khedr (1986) mentioned that nitrogen fertilizer had highly significant effect on ear length and diameter as well as number of grains/row.

Boquet *et al.* (1988) found that number of ears/acre was increased, while number of grains/ear decreased with increasing plant population densities. However, increasing nitrogen fertilizer levels led to significant increase in number of grains/ear.

Gouda (1989), Nigem (1989), Dawood *et al.* (1992), Gouda *et al.* (1992), Nawar *et al.* (1992), Gaafar (1993), Mohamed (1993), Esmail and EI-sheikh (1994),Mokadem and Salem (1994) and shafshak *et al.* (1994) reported that increasing nitrogen fertilizer levels up to 120-150 kg N/fed significantly increased ear diameter, ear length, number of rows per ear and number of grains per row.

Shalaby *et al.* (1994) pointed out that number of rows /ear and number of grains/row were increased with increasing nitrogen levels

from 192 kg N/ha to 336 kg N/ha., whereas these traits were decreased with increasing nitrogen levels up to 552 kg N/ha. The same results were obtained **by Basha *et al.* (1995), Hammam (1995) and Ibrahim *et al.* (1995).**

Younis *et al.* (1995) indicated that ear length, ear diameter and number of grains/row tended to increase as plant density decreased from 20000 to 40000 plants/fed. they also added that increasing nitrogen fertilizer levels up to 120 kg N/fed didn't affect ear characteristics. The response of ear diameter, number of rows/ear and number of grains/row to nitrogen levels was found to be significant by increasing nitrogen fertilizer levels.

Soliman *et al.* (1995) demonstrated that increasing nitrogen fertilizer levels up to 130 kg N/fed. significantly increased ear length, ear diameter and number of grains/row.

Abd El-Gawad and El-Batal (1996) reported that increasing nitrogen levels gradually increased ear length and number of grains.

Ashoub *et al.* (1996) and El-Habbak (1996) reported that increasing N- fertilization levels up 120 or 130 kg N/ fed. caused a significant increase in ear length, ear diameter and number of grains/row.

Faisal *et al.* (1996) and saied *et al.* (1996) reported that increasing nitrogen fertilizer levels form 90 to 120 kg N/fed significantly increased number of grains/row.

Abd El-Hameed (1997) found that increasing nitrogen levels from 0 to 120-130 kg N/fed. significantly increased ear length, ear diameter and number of rows/ear.

Hassanein *et al.* (1997) indicated that ear diameter and number of grains/row were significantly increased by increasing nitrogen levels up to100 kg N/fed. In addition, he also stated that ear length was significantly increased by increasing N fertilizer level up to 125 kg N/fed.

El-Moursy *et al.* (1998) showed that raising nitrogen fertilizer levels up to 90 kg N/fed. significantly increased ear length, ear diameter and number of grains/row.

Faisal and Shalaby (1998) concluded that ear length and ear diameter was significantly increased as the levels of N-fertilizer increased. While it had insignificant effect on number of rows/ear and number of grains/row.

Osman (1998), Hassan (1999) and Nofal (1999) showed that ear length, ear diameter and number of grains/row were steadily increased with the addition of nitrogen fertilizer levels up to 130-150 kg N/fed.

Stone *et al.* (1998) stated that the effect of nitrogen fertilization on yield was more impact at high plant density (90000 plants/ha). Quality characteristics such as ear size and tip fill were consistently improved by N treatments throughout the plant density of (30000-140000 plants/ha).

Turgut (2000) found that increasing nitrogen rates up to 400 kg N/ha led to statistically significant increases in ear diameter and seed number per ear.

El-Far (2000) and El-Ganayni (2000) indicated that the application of nitrogen fertilizer at the rate of 120 kg N/fed. significantly increased ear diameter and number of grains/row.

Raja (2001) stated that increasing nitrogen fertilization from 80 to 120 kg N/ha gave significant increase in the number of primes , ear length and ear girth.

EL-Bana (2001) and soliman *et al.* (2001) showed that raising nitrogen levels up to 120 kg N/fed significantly increased ear length ear diameter and number of grains/row. On the other hand**, El-Hassanin *et al.* (2002)** reported that the response of ear characteristics to applied nitrogen fertilizer was up to 135 kg N/fed.

El-Nagar (2002) found that nitrogen fertilization had a significant effect on ear length, ear diameter, number of rows/ear and number of grains/row.

Darwish (2003), El-shenawy (2003) and Oraby *et al.* (2003) reported that ear length and number of grains/ row were significantly increased by increasing nitrogen fertilizer levels up to 120 kg N/fed.

Hassan (2004) indicated that increasing nitrogen fertilization levels from 0 to 180 kg N/ fed. led to significant increase in ear length, ear diameter and number of grains/ row in both growing both seasons.

2-3 Effect of Nitrogen Fertigation Levels and Calcium Foliar Application on Yield Characteristics

2-3-1 Weight of 1000 grain

Kamel *et al.* (1986) showed that the weight of 100- grain. was significantly increased as nitrogen levels were increased up to 90 kg N/fed. On the other hand, **Khedr (1986), Gouda (1989), Awad *et al.* (1988), Saied *et al.* (1996), Abd El-Hameed (1997)**, **Faisal and Shalaby (1998**), **Saied and Gaber (1999), El-Far (2000), El-Ganayni (2000), El- Bana (2001), El-Metwally *et al.* (2001), Soliman *et al.* (2001**), **El-Hassanin *et al.* (2002), El-Nagar (2002) and Oraby *et al.* (2003)** reported that the response of these traits to nitrogen fertilization was more pronounced up to 120 kg N/fed. Meanwhile, **El-Habbak and Shams El-Din (1996)** added that the response of maize grain yield to nitrogen fertilizers was up to 130 kg N/fed.

Faisal *et al.* (1996) found that increasing N levels from 90 to 120 kg N/fed. significantly increased grain yield/fed. in the two growing seasons. the same findings were obtained by **Hammam (1995)** who added that the increase in grain yield was mainly due to higher number of grains/ ear and 100- grain weight

Zhang *et al.* (1998) stated that under condition of normal cultivation yields were 3.80-5.95 t/ha and with fertilizer application were 4.43-7.4 t/ha. Fertilizer application to the seed bed of 50 g urea, 250 g calcium phosphate, 50 g potassium chloride and 12-15

Kg night soil (faeces) /m^2 increased number of grains/ ear and weight of 1000- grain.

Hassan (2004) proved that increasing nitrogen fertilization levels from 0 to 180 kg N/ fed. led to an increase in 100-grain weight in both growing seasons.

2-3-2Ear yield

Sanmanechai *et al.* (1984) stated that sweet corn yield increased with increasing N rates up to 135 kg/ha, also N uptake increased up to 180 kg N/ha.

Smith (1984) found that limes application led to significant in increases vigor yield, as weight husked-percentage of marketable ears.

Gouda (1989) showed that increasing N levels from 90 to 120 kg N/fed. led to a significant increase in ear yield and grain yield/ fed. in the first season, while in the second season, the two characters were increased only when N levels were raised from 50 to 120 kg N/fed.

Nigem (1989) studied the effect of four N levels (0, 40, 80, and 120 kg N/fed.) on grain yield of nine maize varieties. It was found showed that increasing N fertilizer up to 80 kg N/fed. increased grain yield

Mannino *et al.* (1990) reported that maize grain yield was significantly increased from 12.17 to 14.28 t/ha by increasing nitrogen fertilizer levels from zero to 250 kg N/ha. they also obtained maximum grain yield by planting maize at the rate of 8 plants/m^2.

Younis *et al.* (1995) proved that increasing N levels from 90 up to120 kg N/fed. increased grain yield/fed. As for calcium effect, **Oyewole and Aduayi (1992)** studied the effect of applying Ca to tomato plants grown in pots for 5 months at the rate of 0, 40, 80, and 160 ppm as $Ca(OH)_2$. they stated that applied ca at the rate of

160 ppm, led to an increase in total fruit yield compared to other calcium treatments.

in sandy soil**, Candilo *et al.* (1994)** applied Ca to the soil at the rate of 0, 300 or 600 kg CaO/ha or alternatively as foliar spray at 420 ppm CaO. All calcium treatments significantly increased tomato marketable fruit yield compared to the control. The highest total yield was obtained with 300 kg CaO to the soil (107.1 t/ha) and foliar of CaO (105.2 kg/ha).

Hunter *et al.* (1995) stated that application of $CaCo_3$ rates (0- 5 and 10 Mg/ha) and green manure rats(7.5 and 15Mg/ha) led to increasing growth and yield of sweet corn but green manure was more effective than lime in increasing corn yield.

2-3-3 Un-husked ear weight and husked ear weight

Yodpetch and bautista (1984) showed that increasing the nitrogen rate from 90 to 270 kg N/ha led to an increase in ear yield.

Sanchez *et al.* (1989) found that increasing the rates of N fertilizer application caused an increase in marketable sweet corn yields from 11.2t/ha without N to 120.6 t/ha. with the application 20kg N/ ha. this application also increased ear quality.

Stoyanova *et al.* (1994) stated that increasing nitrogen fertilization rates from 60 and 160 up to 200 kg N/ha. did not show any significant effect on plant growth rate but yield was significantly higher with 160kg N/ha.

Mahgoub *et al.* (1991) reported that yield increased as N levels increased up to the highest levels (105 kg N/fed.)

Salardini *et al.* (1992) found that the highest cob yield (23.1 t/ha) and fresh shoots 93.8 t/ha and the highest concentration of N in cobs and shoot dry matter(DM), were obtained when N application increased.

Hochmuth *et al.* (1995) stated that increasing nitrogen application from 0 to 200) Ib/acre led to linear and quadratic