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# PERFORMANCE OF TWO PROMISING SUGAR CANE VARIETIES UNDER DIFFERENT HARVESTING DATES

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## ABSTRACT

Tow field experiments were carried out at Mallawi Agricultural Research Station, Minia Governorate grown as plant cane in 2008/2009 and 2009/2010 seasons and the 1st ratoon crops in 2009/2010 to investigate three harvest dates at ages of (10, 12 and 14 months) on the performance of two promising sugar cane varieties G.99-80, G.99-160 and the commercial variety G.T.54-9 as a control. A split plot design with four replications was used in both seasons. Harvest dates treatments were allocated in the main plots while sugar cane varieties were randomly distributed in the sub plots.

The results showed that harvest date up to 14 months recorded the highest values of stalk height, weight kg/plant and cane yields/fed in plant cane and 1st ratoon crops over the other two harvest dates.

Sugarcane varieties differed significantly, where G.99-80 variety recorded the highest stalk height, weight kg/plant, cane and sugar yields in the plant cane and 1st ratoon crop over the other two varieties., in respectively. G.99-160 variety surpassed G.99-80 and G.T.54-9 varieties in brix% in plant cane in both seasons and 1st ratoon crop. G.T.54-9 surpassed in stalk diameter, sucrose% and sugar recovery%.

The interaction between sugar cane variety G.99-80 and 14 months harvest date in 1st plant cane and 1st ratoon crop to obtain the highest cane yields. Under conditions of this work, 14 months for the plant cane and the 1st ratoon crop of G.99-80 variety grown at Mallawi represent Middle Egypt can be recommended to obtain the highest cane and sugar yields/fed.

## INTRODUCTION

Egyptian Government imports about 1.10 million ton of sugar, every year to face the rapid increase of population. Sugar cane plays a prominent role in sugar production, the local production of sugar amounted to 1.7 million tons/year (69%) out of which is produced from sugar cane and the rest from sugar beet (CCSC, 2010). It is imperative to define precisely the mature age of a variety in order to maximize sugar production at a minimum cost. Ramesh and Mahadevaswamy (1996) tested four sugar cane varieties for harvest ages (10, 11, 12 and 13 months). 12 months was the most suitable ages for cane and sugar yields/fed. Also, different maturity periods are needed throughout the crushing season which extend from late December to late May and/or sometimes to early June. Changes in juice quality proved to be vital importance for both cane grower and processor. Maturity periods which extend from 10 to 14. changes differ in yields/fed, its components and quality, which proved to be of vital importance for both cane grower and processor. (Yadav and Sharma, 1980; Sharma *et al.*, 1991; Abdalla *et al.*, 1995; Perumal 1997; Singh *et al.*, 1997; Khandagve, 1999 and Mohamed and Abou-Dooh, 2002). Ahmed (2003) tested three promising sugar cane for harvest ages (10, 11, 12, 13 and 14 months). He found that 14 months was

the most suitable ages for yields/fed and its components (millable cane height, diameter and weight) as well as brix%, sucrose%, sugar recovery% at plant cane or ratoon crops. El-Sogheir and Besheit (2003) tested three sugar cane varieties under two harvest ages 12 and 13 months. They found that 13 months age were recorded the highest values than the other harvest age 12 months for cane yields/fed, juice quality% and hence sugar yields/fed/unit area. El-Sogheir and Ferweez (2009) tested sugar cane varieties under harvest ages (10, 11, 12 and 13 months). 12 and 13 months was the optimum harvest ages for cane and sugar yields/fed.

In Egypt, sugar cane is the main resource of raw material for sugar industry. It is considered the most important economic crop in Upper Egypt. The extracted sugar basically start from the field and depends upon agronomical processes and varieties used. The new sugar cane varieties is considered one of the essential wings for production. Productivity of sugarcane depends upon cane yield and its components traits, while sugar yield as a final product is greatly affected by cane yield and quality traits at harvest. El-Sogheir *et al.* (2003), Osman *et al.* (2004),and Ahmed *et al.* (2005) found that Phil.8013, G.74-96, G.95-21 and G.T.54-9 varieties differed significantly in number of plants/$m^2$, sugar recovery%, cane and sugar yields/fed in plant cane and 1$^{st}$ ratoon crops. While, G.74-96 recorded significant increased in stalk diameter and sugar recovery%. The commercial cv. G.T.54-9 showed that superiority in stalk length, sugar recovery% and sugar yields, while higher number of millable canes/fed and cane yields/fed were given by G.95-21 variety. Thicker stalks was recorded by Phil.8013 variety. Mohamed and Ismail (2002) and El-Sogheir and Ferweez (2009) found that Phil.8013, G. 84-47 and G. 98-28 in descending order could be cultivated and/or replaced with the main variety G.T.54-9 which yielded the best quality, cane and sugar yields/unit area. Allabody *et al.* (2010), El-Zeny, Maha, *et al.* (2010) and Osman *et al.* (2010) found that varieties, i.e. G.T.54-9, Phil.8013 and G.98-28 and G.84-47 of sugar cane, had significant effect on stalk length and diameter, as well as, sucrose%, sugar recovery%, cane and sugar yields/fed in the plant cane and 1$^{st}$ ratoon crops. G.84-47 and/or G.98-28 surpassed the others varieties.

The present study aimed at finding out the suitable sugar cane variety (promising) and the commercial one with respect to yield and quality under different harvest dates in Minia Governorate representing the Middle Egypt condition.

## MATERIALS AND METHODS

Tow field experiments were carried out at Mallawi Agricultural Research Station, Minia Governorate grown as plant cane in 2008/2009 and 2009/2010 seasons and the 1$^{st}$ ratoon crops in 2009/2010 to investigate three harvest dates at ages of (10, 12 and 14 months) on the performance of two promising sugar cane varieties G.99-80, G.99-160 and the commercial variety G.T.54-9 as a control. A split plot design with four replications was used in both seasons. Harvest dates treatments were allocated in the main plots while

sugar cane varieties were randomly distributed in the sub plots. The Plot area was 42 $m^2$, including 7 rows of 1 m apart and 6 m in length. Two rows of three budded cane cuttings were used in planting. The previous crop was berseem. Sugar cane varieties were planted as plant cane crop in the 1st week of March in both seasons and 1st ratoon crops raised in the 1st week of March and harvested at age of twelve months. Recommended NPK fertilizers were added at rates of 210 kg N (as Urea 46.5% N/fed), 30 kg $P_2O_5$ (as calcium superphosphate 15.5% $P_2O_5$/fed) and 24 kg $K_2O$ (as potassium sulphate 48% $K_2O$/fed. Nitrogen and potassium fertilizers were added in two equal doses. In the plant cane, the 1st N dose and potassium were applied two months after planting preceded with hoeing. In the 1st ratoon, the 1st N-dose and potassium were added one after month from harvesting the plant cane and after furrowing (ditching between rows of sugarcane) and earthing-up. The 2nd dose were added one month after the 1st one, for both cane crops. Phosphorus fertilizers was applied during seed bed preparation. The other agricultural practices were followed as recommended by Sugar Crops Research Institute.

**Recorded data:**

**1. Vegetative chgaracters:** At each harvesting date, a sample of 10 millable canes from each sub plot was taken at random and the following data were recorded:

1. Millable cane stalk height (cm), which was measured from soil surface to the top point of visible dewlap.
2. Millable cane diameter, which was measured at the middle part of stalk.
3. Millable cane weighted (kg/plant) were done

**II. Cane and sugar yields (ton/fed):** Each sub plot was harvested, topped and cleaned from trash, weighed to estimate the following characters:

1. Cane yield (tons/fed) was calculated.
2. Sugar yield (tons/fed) was estimated according to the following equation: Raw sugar yield (ton/fed) = cane yield (ton/fed) x sugar recovery%.

**III. Juice quality traits:** a sample of 20 millable cane stalks was collected immediately after harvest, stripped and squeezed then juice was extracted using 3- rool lab mill, filtrated and weighed to determine the following quality traits as described by A.O.A.C. (2005): Juice extraction%, was calculated using the following equation: Juice extraction% = juice weight x 100/stalk weight. Juice extraction% about 58-60% from cane weight.

1. Brix% was determined by using the Brix Hydrometer standardized at 20°C.
2. Sucrose%, was determined using "Saccharemeter" according to A.O.A.C. (2005).
4. Sugar recovery%, was calculated according to Yadav and Sharma (1980). Sugar recovery% = {Sucrose - 0.4 (brix – sucrose) 0.73}.

Data were statistically analyzed according to Snedecor and Cochran (1981).

## RESULTS AND DISCUSSION

**1. Harvest dates differences:**

Results in Table 1 revealed that harvest dates significantly differed in stalk height, diameter, weight kg/plant, brix%, sucrose%, sugar recovery%, cane and sugar yields/fed in the plant cane in both seasons and 1st ratoon crops. Harvest date 14 months recorded the highest mean values of stalk height, weight kg/plant, cane and sugar yields/fed, whereas 10 months recorded the lowest ones, except brix% where it recorded the highest values than the other two harvesting dates. Otherwise, 12 months recorded the highest values of stalk diameter, sucrose and sugar recovery% in the plant cane and 1st ratoon crops.

**Table 1: Effect of harvest dates on growth, quality and yields traits at harvest.**

| Harvest dates (months) | Stalk height | Stalk diameter | Stalk weight (kg/plant) | Brix% | Sucrose % | Sugar recovery % | Yield (ton/fed) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Cane | Sugar |
| 1st plant cane (2008/2009) | | | | | | | | |
| 10 | 245 | 2.94 | 1.013 | 23.81 | 14.51 | 9.61 | 46.98 | 4.51 |
| 12 | 257 | 3.00 | 1.072 | 18.07 | 19.46 | 11.53 | 49.73 | 5.73 |
| 14 | 274 | 2.96 | 1.133 | 22.14 | 17.46 | 11.22 | 52.53 | 5.89 |
| LSD at 5% | 4.10 | 0.02 | 0.03 | 1.45 | 1.25 | 0.80 | 1.12 | 0.51 |
| 2nd plant cane (2009/2010) | | | | | | | | |
| 10 | 239 | 2.95 | 0.988 | 23.14 | 14.31 | 9.58 | 46.13 | 4.42 |
| 12 | 254 | 3.15 | 1.047 | 18.22 | 19.05 | 11.64 | 49.89 | 5.81 |
| 14 | 302 | 3.00 | 1.150 | 21.75 | 16.34 | 11.30 | 53.48 | 6.04 |
| LSD at 5% | 2.65 | 0.02 | 0.01 | 1.02 | 0.98 | 0.55 | 0.95 | 0.4 |
| 1st ratoon crop (2009/2010) | | | | | | | | |
| 10 | 252 | 2.89 | 0.966 | 23.63 | 16.25 | 9.91 | 47.16 | 4.67 |
| 12 | 265 | 2.95 | 1.009 | 21.61 | 20.06 | 11.86 | 50.61 | 6.00 |
| 14 | 298 | 2.92 | 1.093 | 22.60 | 18.00 | 11.64 | 54.09 | 6.30 |
| LSD at 5% | 1.75 | 0.01 | 0.02 | 0.99 | 0.88 | 0.65 | 0.75 | 0.35 |

12 months harvest dates recorded the highest values compared with the other two harvesting dates 10 and 14 months. Such effect might be attributed to increase of growth as expressed in stalk height and hence an expected increase in yield, which refers to a dilution effect to the juice content from brix%, sucrose% and sugar recovery%. The increase in sugar yield may be due to increased in sucrose%, sugar recovery% which reflected on sugar yield as a final product. These data are in partial agreement with those obtained by Ramesh and Mahadevaswamy (1996), Jadhav *et al.* (2000), Ahmed (2003)and El-Sogheir and Besheit (2003) they found that stalk height and diameter were increased gradually as harvesting time was delayed and Abd El-Azez (2008) found that sucrose% was decreased when harvest was delayed to 13 months from sowing in both seasons.

**2. Varietal differences:**

The obtained results in Table 2 found that varieties significantly differed in stalk height, diameter, weight kg/plant, brix%, sucrose%, sugar recovery%, cane and sugar yields/fed in the plant cane in both seasons and 1st ratoon crops. G.99-80 variety had the highest values of stalk height, weight kg/plant, cane and sugar yields/fed, whereas G.99-160 variety recorded the lowest ones, except brix% where it recorded the highest values compared with the other two cane varieties in the plant cane in both seasons and 1st ratoon crops. The increase in cane yield for G.99-80 variety was strongly related to the higher stalk performance i.e. stalk length and weight at harvest which reflected consequently on cane yields. The increase in sugar yield for G.99-80 variety may be due to superiority in sucrose%, sugar recovery% which reflected consequently on sugar yields. G.T.54-9 variety recorded the highest mean of stalk diameter, sucrose and sugar recovery% compared with the other two cane varieties in the plant cane and 1st ratoon crops. These differences could be attributed to the genetic structure of the evaluated sugarcane varieties. Similar results were reported by El-Sogheir and Ferweez (2009), Allabody *et al.* (2010) and Osman *et al.* (2010).

**Table 2: Effect of varietal differences on growth, quality and yield traits at harvest.**

| Varieties | Stalk height | Stalk diameter | Stalk weight (kg/plant) | Brix% | Sucrose % | Sugar recovery % | Yields (ton/fed) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Cane | Sugar |
| **1st plant cane (2008/2009)** | | | | | | | | |
| G.99-160 | 256 | 2.86 | 1.017 | 22.04 | 17.00 | 10.14 | 48.05 | 4.87 |
| G.T.54-9 | 262 | 3.04 | 1.099 | 21.02 | 17.80 | 11.16 | 49.46 | 5.52 |
| G.99-80 | 264 | 2.99 | 1.201 | 21.29 | 16.73 | 11.07 | 51.72 | 5.73 |
| LSD at 5% | 2.10 | 0.01 | 0.01 | 0.85 | 0.68 | 0.55 | 0.88 | 0.31 |
| **2nd plant cane (2009/2010)** | | | | | | | | |
| G.99-160 | 260 | 3.05 | 1.007 | 22.01 | 16.36 | 10.71 | 48.72 | 5.22 |
| G.T.54-9 | 261 | 3.09 | 1.079 | 20.76 | 17.31 | 10.92 | 49.64 | 5.42 |
| G.99-80 | 266 | 2.89 | 1.091 | 20.94 | 16.11 | 10.90 | 51.14 | 5.57 |
| LSD at 5% | 1.12 | 0.01 | 0.01 | 0.77 | 0.42 | 0.10 | 0.54 | 0.22 |
| **1st ratoon crop (2009/2010)** | | | | | | | | |
| G.99-160 | 261 | 2.96 | 1.033 | 22.86 | 17.80 | 10.98 | 48.33 | 5.31 |
| G.T.54-9 | 266 | 3.00 | 0.933 | 22.15 | 18.19 | 11.48 | 50.00 | 5.74 |
| G.99-80 | 285 | 2.83 | 1.080 | 22.26 | 18.15 | 10.96 | 53.52 | 5.87 |
| LSD at 5% | 0.95 | 0.01 | 0.01 | 0.25 | 0.45 | 0.33 | 0.23 | 0.12 |

**3. Significant interactions:**

The obtained results in Table 3 showed that harvesting G.T.54-9 variety at 12 months age gave the highest values of sugar recovery% compared to the other interactions in the 1st plant and ratoon crops. Respectively.

**Table 3: Interaction effect between harvest dates x varieties on quality and yields at harvest.**

| Harvest dates (months) | Sugar recovery% | | | Cane yield (ton/fed) | | | Sugar yield (ton/fed) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st plant cane (2008/2009) | | | | | | | | |
| | G. 99-160 | G.T. 54-9 | G. 99-80 | G. 99-160 | G.T. 54-9 | G. 99-80 | G. 99-160 | G.T. 54-9 | G. 99-80 |
| 10 | 9.16 | 9.91 | 9.77 | 45.96 | 46.39 | 48.58 | 4.21 | 4.60 | 4.75 |
| 12 | 11.05 | 11.79 | 11.76 | 47.85 | 49.58 | 51.75 | 5.29 | 5.85 | 6.09 |
| 14 | 10.21 | 11.77 | 11.69 | 50.33 | 52.41 | 54.84 | 5.14 | 6.17 | 6.41 |
| LSD at 5% | 0.25 | | | 1.10 | | | 0.23 | | |
| | 1st ratoon crops (2009/2010) | | | | | | | | |
| 10 | 9.76 | 10.10 | 9.87 | 45.19 | 46.93 | 49.35 | 4.41 | 4.74 | 4.87 |
| 12 | 11.62 | 12.37 | 11.60 | 47.98 | 49.63 | 54.21 | 5.58 | 6.14 | 6.29 |
| 14 | 11.55 | 11.96 | 11.42 | 51.83 | 53.44 | 56.99 | 5.99 | 6.39 | 6.51 |
| LSD at 5% | 0.88 | | | 0.97 | | | 0.14 | | |

Also, the interactions between harvesting G.99-80 variety at 14 months age gave the highest values of cane and sugar yields/fed compared to the other interactions in the 1st plant and 1st ratoon crops, respectively.

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## أداء بعض اصناف القصب المبشرة تحت مواعيد حصاد مختلفة

**محمود سيد حسن عثمان ، اشرف حنفى سيد احمد اللبودى وعادل محمود حسن عثمان**
**معهد بحوث المحاصيل السكرية – مركز البحوث الزراعية – جمهورية مصر العربية**

أقيمت تجربتان حقليتان بمحطة بحوث ملوى بمحافظة المنيا خلال موسمى ٢٠٠٨/٢٠٠٩ و٢٠٠٩/٢٠١٠ (كقصب غرس) وموسم ٢٠٠٩/٢٠١٠ (كخلفة اولى) لدراسة تأثير ثلاث مواعيد حصاد (١٠،١٢ و١٤ شهر من الزراعة) على محصول الغرس والخلفة الاولى لصنفين مبشرين من قصب السكر وهى (جيزة ٩٩-٨٠ وجيزة ٩٩-١٦٠ بالاضافة للصنف التجارى جيزة تايوان ٥٤-٩ كمقارنة). إستخدم تصميم قطع منشقة مرة واحدة فى اربع مكررات حيث وضعت مواعيد الحصاد فى القطع الرئيسية ووضعت الاصناف فى القطع الشقية. اوضحت النتائج ما يلى:

- اختلفت مواعيد الحصاد معنويا فى ارتفاع الساق وقطره ووزن الساق والبركس والسكروز وناتج السكر ومحصولى العيدان والسكر فى الغرس والخلفة. ادى تاخير ميعاد الحصاد الى ١٤ شهر من الزراعة الى الحصول على اعلى قيم لارتفاع الساق ووزن الساق ومحصول العيدان بينما ادى الحصاد على ١٢ شهر الى الحصول على اعلى قطر وسكروز وناتج سكر ومحصول سكر بينما ادى الحصاد على ١٠ شهور الى ارتفاع النسبة المئوية للبركس والحصول على اقل القيم للصفات المدروسة.
- اختلفت الاصناف معنويا فى ارتفاع الساق وقطره ووزن الساق والبركس والسكروز وناتج السكر ومحصولى العيدان والسكر. سجل الصنف جيزة ٩٩-٨٠ أعلى القيم لارتفاع الساق ووزن الساق ومحصولى العيدان والسكر فى كلا من موسمى الغرس والخلفة على التوالى. بينما حقق الصنف جيزة تايوان ٥٤-٩ اعلا قطر ساق ونسبة سكروز وناتج سكر. بينما حقق الصنف جيزة ٩٩-١٦٠ اعلا نسبة مئوية للبركس واقل القيم للصفات المدروسة.
- كان للتفاعل بين الاصناف المختبرة ومواعيد الحصاد تاثيرا معنويا على النسبة المئوية لناتج السكر ومحصولا العيدان والسكر فى الغرس والخلفة. حيث سجل الصنف جيزة ٩٩-٨٠ اعلا محصول عيدان عند الحصاد على ١٤ شهر وكذا اعلى محصول سكر عند الحصاد على ١٢ شهر بينما ادى الحصاد على ١٢ شهر مع الصنف جيزة تايوان ٥٤-٩ الى الحصول على اعلى ناتج سكر فى الغرس والخلفة على التوالى.

نوصى بزراعة الصنف جيزة ٩٩-٨٠ مع ميعاد حصاد ١٤ شهر للحصول على أعلى محصول.

**قام بتحكيم البحث**

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|---|---|
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