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# THE EFFECT OF CULTIVAR AND HARVEST TIME ON YIELD AND QUAILTY OF SUGAR CANE

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## ABSTRACT

**Harvest time of sugar cane is considered as one of the important factors, particularly for developing countries, for processing period . So, to field experiments were conducted at farm of Malawi Agric. Res., Station, El.Minia governorate, Egypt, during ٢٠٠٩/٢٠١٠ and ٢٠١٠/٢٠١١ seasons the work aimed to study the effect of different harvesting dates on yield and quality of some sugar cane varieties under El-Minia governorate conditions . A split plot design with four replicates was used where the three harvesting dates, i.e. ١١.٠, ١٢.٠ and ١٣.٠ months were arranged in the main plots and the three sugarcane varieties namely Giza Taiwan (G.T.) ٥٤-٩ (the commercial variety), Giza(G.)٢٠٠١-٧٩ and Giza(G.) ٨٤-٤٧ were allocated in the sub plots.**

**The obtained data pointed out that harvesting time had a significant effect on total soluble solids% (TSS%) , sucrose%, purity%, pol%, sugar recovery%, , reducing sugars %, millable cane and recoverable sugar yields of sugar cane in the two growing seasons.**

**The tested varieties differed significantly in stalk height, quality parameters, i.e. TSS %juice , sucrose% juice , pol% cane ,sugar recovery % and reducing sugars % of sugar cane, as well as productivity traits(millable cane and recoverable sugar yields) in the two growing seasons.**

**A significant interaction was found between harvesting date and sugar cane varieties with regard to total soluble solids% (TSS%) , sucrose%, pol%, sugar recovery% and millable cane**

**yield. It can be concluded from the results that G.٨٤-٤٧ variety with harvesting time at ١٢ months age scored the highest value (٥.٧٣ tons/fed ) of recoverable sugar yield and therelore it could be recommended for maximizing sugar cane productivity under Minia Governorate conditions.**

## INTRODUCTION

The need for increasing sugar production in most developing countries, because an ultimate goal to meet the dramatic expansion of their populations . Sugarcane is the main crop in the world as well as in the Egypt for sugar production. Increasing the production of the unit area vertically become the main goal not only for the grower and the manufacturer but also for the policy maker to minimize the aforementioned gap between sugar production and consumption. The cultivated area of sugar cane in the world estimated by ٤٧ million fed den (fed) . In Egypt the total area of sugar cane in ٢٠١٠ was estimated as ٣١٦٧١٢ fed den produced about ١٥.٥ million tons with an average of ٤٨.٨٨ tons/fed den. It produced approximately ٥٠.٣٪ of ١.٩ million tons of local sugar production. Sugarcane plantation in Minia Governorate (nearly ٣٨٧٢٥ fed den) is directed to sugar and treacle production as well as to the fresh use of cane juice (ESST, ٢٠١٠ and CCSC, ٢٠١١).

Sugar cane is harvest over a ٦- months (Junaury – May ) period in Egypt as well as in different growing environments. While many studies have examined the interaction of genotype X environment and its implication for breeding program design , knowledge is limited on the interaction of genotype and time of harvest and implications of these interaction for growers . Cultivar and time of harvest had significant effect on sugar and cane yields (ton/fed). Sugar yield of cane yield was reduced by ٢٨ and ٢٩٪ , respectively , when harvested early compared to optimum harvest dates (Gilbert, et al. ٢٠٠٦ ).

As for varieties differences, Ahmed (١٩٩٨) demonstrated that sugarcane varieties are completely different in their performance, quality and yields due to great variation in their gene structure. Abd El-Azez (٢٠٠٨) evaluated some sugarcane varieties (G. ٨٤-٤٧, G. ٩٩-١٠٣, G. ٩٨-٢٨, G. ٩٨-٨٨, Phil.٨٠١٣ and the commercial

variety(G.T.٥٤-٩). He revealed that, sugarcane varieties differed significantly in stalk height, stalk diameter, millable cane and recoverable sugar yields. Moreover, the tested varieties differed in quality parameters (TSS%, purity % and sugar recovery %). In addition , El.Sogheir and Ferweez (٢٠٠٩ ) tested five sugar cane varieties (G. ٨٤-٤٧, G. ٩٩-١٠٣, G. ٩٨-٢٨, Phil.٨٠١٣ and G.T. ٥٤-٩). They indicated that G. ٨٤-٤٧ surpassed all tested varieties in quality parameters (TSS %, purity % and sugar recovery %) and millable cane yield. Abd El-Fattah (٢٠١٠) examined four sugar cane varieties (G.٩٩-١٠٣, G.٩٨-٢٨, Phil.٨٠١٣ and G.T.٥٤-٩). He found that G.٩٩-١٠٣ variety ranked the first in stalk height, diameter and weight, as well as Phil.٨٠١٣ and G.T.٥٤-٩ varieties gave the best values of quality parameters, i.e., TSS %, purity % and sugar recovery %. This investigation was performed to evaluate the effect of cltivar and harvest time on yield and quality of some sugar cane varieties under El-Minia governorate conditions.

## MATERIAL AND METHODS

Two field experiments were conducted at farm of Malawi Agric. Res., Station, El.Minia governorate, Egypt, during ٢٠٠٩/٢٠١٠ and ٢٠١٠/٢٠١١ seasons to study the effect of different harvesting dates on yield and quality of some sugar cane varieties under El-Minia governorate conditions . A split plot design with four replicates was used, where the three harvesting dates, i.e. ١١.٠, ١٢.٠ and ١٣.٠ months were arranged in the main plots and the three sugarcane varieties namely: G.T. ٥٤-٩ (the commercial variety), G.٢٠٠١-٧٩ and G. ٨٤-٤٧ were allocated in the sub plots. Plot area was ٤٢ $m^2$ (١/١٠٠ fed.), including ٦ ridges; ٧ m long and ١ m apart. Planting dates were on the ٢٢$^{th}$ and ٢٩$^{th}$ March during ٢٠٠٩/٢٠١٠ and ٢٠١٠/٢٠١١ seasons, respectively. The Phosphorus fertilizer at the rate of ٦٠ kg/fed. was added broadcasted after ridging and before planting for plant cane as calcium superphosphate (١٥.٥٪) . Potassium fertilizer at the rate of ٤٨ kg/fed as calcium sulphate(٤٨٪$K_2O$) was applied as side dressing in cane rows after ٥٠ days from planting . Nitrogen fertilizer as urea (٤٦.٥٪N) was added at the recommended rate of ١٨٠ kg N /fed. in

two equal doses as side dressing (the first dose after full emergence of cane plants and the second ones month later).

The chemical and physical properties of the experimental soil before soil preparation were determined according to the procedures outlined by Jackson (١٩٦٧) are shown in Table (١).

**The following data were recorded at harvest :**

**١.Vegetative characters :**

١.١-Millable stalk height (cm) was measured from ground level to top visible dewlap(TVD) .

١.٢-Millable stalk diameter (cm) was measured at the middle part of stalk

**٢. Quality parameters : A sample of approximately ٢٥ kg clean stalk, were drawn per plot and send to the laboratory for quality analysis.**

٢.١. Total soluble solids (TSS%) was determined using "Brix hydrometer" standardized at ٢٠ ˚C .

٢.٢. Sucrose%juice was determined using succharometer as described in A.O.A.C. (١٩٩٥).

٢.٣. Purity% juice was calculated as reported by Satisha *et al.*(١٩٩٦) using the following formula: Purity %= Sucrose % x ١٠٠ ÷ TSS%

٢.٤. Pol% cane was calculated by the following equation as described by Mathur (١٩٨١). Pol %cane={TSS%–(TSS%- sucrose %juice)٠.٤}٠.٧٣.

٢.٥.Sugar recovery% was calculated by the following equation according to the outlined procedures of Sugar and Integrated Industries Co.

Sugar recovery%={(Pol%cane-٠.٨ ÷ Purity% juice) x (Purity% juice – ٤٠ ÷ ١٠٠ - ٤٠)} x١٠٠

٦.٦. Quality index of cane stalks (quality index%cane )was calculated by the following equation:Quality index = Sugar recovery% x ١٠٠ ÷ Pol% cane .

**٣. Productivity traits** :

٣.١. Millable cane yield (ton/fed.): cane stalks of the four inner rows in each plot were harvested, topped ,cleaned ,weighted and cane yield was calculated as ton / fed .

٣.٢. Recoverable sugar yield (ton/fed.) was estimated according to Mathur (١٩٨١) using the following equation : Recoverable sugar yield (ton/fed.) = Millable cane yield (ton/fed.) x Rendement

**Table ١ : Some physical and chemical characteristics of the experimental soils*.**

| Properties | Season ٢٠٠٩/٢٠١٠ | Season ٢٠١٠/٢٠١١ |
|---|---|---|
| **Texture analysis:** | | |
| **Clay %** | ٤٤.٣٠ | ٤٧.٤٠ |
| Silt % | ٣٢.٢٠ | ٢٨.٦٠ |
| Sand % | ٢٣.٦٠ | ٢٤.٠٠ |
| Texture grade: | Clay | Clay |
| pH (١:١ suspention) | ٧.٥٠ | ٧.٥٠ |
| Ec m.mohs (١:١) | ١.٣٢ | ١.١٥ |
| Organic matter % | ١.١٨ | ١.٢٤ |
| **Soluble cations:** | | |
| $Ca^{++} + Mg^{++}$ meq/١٠٠g soil | ٠.٩٦ | ٠.٨٤ |
| $Na^{+}$ meq/١٠٠g soil | ٠.٣٧ | ٠.٤٤ |
| $K^{+}$ meq/١٠٠g soil | ٠.٠٩ | ٠.١١ |
| **Soluble anions:** | | |
| $CO_3$+ $HCO_3$ meq/١٠٠g soil | ٠.٣٣ | ٠.٣٦ |
| $Cl^{-}$ meq/١٠٠g soil | ٠.٨٤ | ٠.٩١ |
| **Available N mg / kg soil** | ٢١.١ | ١٩.٣٥ |
| **Available P (ppm)** | ٨.٥٠ | ٧.٨٥ |
| **Available K mg / kg soil** | ١٧٥ | ١٨٠ |

* Each value represents the mean of ٥ samples

The proper statistical analysis of all data was carried out according to Gomez& Gomez (١٩٨٤). The differences among means of the different treatments were compared using the least significant difference (LSD) at ٥٪ level.

## RESULTS AND DISUSION

### A- Vegetative characters :

The tabulated results in Tables ٢ & ٣ indicated that harvesting date had a significant effect on stalk height of sugar cane varieties in the ٢nd season. It could be noticed from combined analysis that increasing harvesting date from ١١ to ١٢ and ١٣ months increased stalks height and diameter (cm). The third harvesting date scored the highest values of stalk dimensions, stalk height and diameter (٢٩٧.٢٨ and ٢.٦١ cm ) , respectively .

**Table ٢ :Effect of different harvesting dates on stalk height(cm) of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٢٨٨.٠٠ | ٢٦٨.٦٧ | ٢٩٥.٣٣ | ٢٨٤.٠٠ | ٢٩٧.٦٧ | ٢٧٨.٦٧ | ٣٠٥.٠٠ | ٢٩٣.٧٨ | ٢٩٢.٨٣ | ٢٧٣.٦٧ | ٣٠٠.١٧ | ٢٨٨.٨٩ |
| ١٢ months | ٢٩٣.٠٠ | ٢٧٣.٣٣ | ٣٠٤.٠٠ | ٢٩٠.١١ | ٣٠١.٠٠ | ٢٨٣.٦٧ | ٣١٠.٦٧ | ٢٩٨.٤٤ | ٢٩٧.٠٠ | ٢٧٨.٥٠ | ٣٠٧.٣٣ | ٢٩٤.٢٨ |
| ١٣ months | ٢٩٤.٠٠ | ٢٧٥.٦٧ | ٣٠٧.٠٠ | ٢٩٢.٢٢ | ٣٠٣.٣٣ | ٢٩٠.٦٧ | ٣١٣.٠٠ | ٣٠٢.٣٣ | ٢٩٨.٦٧ | ٢٨٣.١٧ | ٣١٠.٠٠ | ٢٩٧.٢٨ |
| Mean | ٢٩١.٦٧ | ٢٧٢.٥٦ | ٣٠٢.١١ | ٢٨٨.٧٨ | ٣٠٠.٦٧ | ٢٨٤.٣٣ | ٣٠٩.٥٦ | ٢٩٨.١٩ | ٢٩٦.١٧ | ٢٧٨.٤٤ | ٣٠٥.٨٣ | ٢٩٣.٤٨ |
| F value | Ns | ** | Ns | | * | ** | Ns | | ** | ** | Ns | |
| LSD ٠.٠٥ | A=-- | B=٥.٨٧ | AB=-- | | A=٤.٨٥ | B=٢.١٨ | AB=-- | | A=٣.٧٠ | B=١.٨١ | AB=-- | |

Ns = Non-significant A= Harvesting date B= varieties
AB= interaction between harvesting date and varieties LSD= least significant differences

The increment of growth gained by delaying harvesting date may be due to developing stalks dimensions by increasing division or elongation of cells and also photosynthesis process (Singh & Singh,٢٠٠٠, El.Sogheir & Besheit,٢٠٠٣and Abd El-Azez ٢٠٠٨) who reported that stalk dimensions of sugar cane increased gradually as harvesting delayed.

**Table ٣ :Effect of different harvesting dates on stalk diameter (cm) of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٢.٥٣ | ٢.٧٣ | ٢.٤٠ | ٢.٥٦ | ٢.٥٧ | ٢.٧٣ | ٢.٤٣ | ٢.٥٨ | ٢.٥٥ | ٢.٧٣ | ٢.٤٢ | ٢.٥٧ |
| ١٢ months | ٢.٥٠ | ٢.٦٧ | ٢.٤٠ | ٢.٥٢ | ٢.٥٧ | ٢.٧٧ | ٢.٤٠ | ٢.٥٨ | ٢.٥٣ | ٢.٧٢ | ٢.٤٠ | ٢.٥٥ |
| ١٣ months | ٢.٥٧ | ٢.٧٧ | ٢.٤٧ | ٢.٦٠ | ٢.٦٠ | ٢.٨٠ | ٢.٤٧ | ٢.٦٢ | ٢.٥٨ | ٢.٧٨ | ٢.٤٧ | ٢.٦١ |
| Mean | ٢.٥٣ | ٢.٧٢ | ٢.٤٢ | ٢.٥٦ | ٢.٥٨ | ٢.٧٧ | ٢.٤٣ | ٢.٥٩ | ٢.٥٦ | ٢.٧٤ | ٢.٤٣ | ٢.٥٨ |
| F value | Ns | ** | Ns | | Ns | ** | Ns | | ** | ** | Ns | |
| LSD ٠.٠٥ | A=-- | B=٠.٠٥ | AB=-- | | A=-- | B=٠.٠٥ | AB=-- | | A=٠.٠٤ | B=٠.٠٣ | AB=-- | |

**The effect of cultivar and harvest time on yield**

Concerning the evaluated sugar cane varieties ,data in Tables ٢ & ٣ indicated that varieties of sugar cane had a significant effect on stalk height of sugar cane varieties in the two growing seasons. It could be noticed from combined analysis that G.٨٤-٤٧ variety scored the highest value (٣٠٥.٨٣ cm) of stalk height and the lowest value (٢.٤٣ cm) of stalk diameter , while the highest value (٢.٧٤ cm) of stalk diameter was recorded for G٢٠٠١-٧٩ variety . This result might be due to the action of gene make-up , which plays an important role in plant structure and morphology . These findings are in the same line with that reported by Nasser *et al.* (٢٠٠٦) ; Comstock , et al. (٢٠١٠ ) and Ferweez *et al. (٢٠١١).*

**B- Quality parameters :**

Results in Tables (٤ and ٥) indicated that harvesting date of sugar cane had a significant effect on total soluble solids% (TSS%), sucrose%, purity%, pol%, sugar recovery%, and reducing sugars % of sugar cane in the two growing seasons. It could be noticed from combined analysis that delaying harvesting date of sugar cane from ١١ to ١٢ and ١٣ months increased total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery% of sugar cane. The third harvesting date scored the highest values of total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery% (٢٢.٧١٪ ,١٨.٨٩٪ , ١٥.٤٦٪ and ١٢.٦٨٪ ) respectively, while the lowest values for these parameters were scored with the early harvesting date (١١months). These findings are in agreement with that mentioned by El.Sogheir&Besheit,(٢٠٠٣)and Abd El-Azez(٢٠٠٨)who reported that the highest values of total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery% are considered an encouragement and careful factors for sugar industry. Comstock,et al.(٢٠١٠)mentioned that the goal of the cultivar development program is to release high yielding cultivar for sugar cane industry.

**Table ٤: Effect of different harvesting dates on total solible solids%juice(TSS%) of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٢٠.٨٣ | ٢١.٠٠ | ٢١.٥٧ | ٢١.١٣ | ٢٠.٦٠ | ٢٠.٧٣ | ٢١.٥٣ | ٢٠.٩٦ | ٢٠.٧٢ | ٢٠.٨٧ | ٢١.٥٥ | ٢١.٠٤ |
| ١٢ months | ٢٢.٣٠ | ٢٢.٦٣ | ٢٢.٧٠ | ٢٢.٥٤ | ٢١.٨٣ | ٢٢.١٧ | ٢٢.٣٧ | ٢٢.١٢ | ٢٢.٠٧ | ٢٢.٤٠ | ٢٢.٥٣ | ٢٢.٣٣ |
| ١٣ months | ٢٢.٧٣ | ٢٢.٩٠ | ٢٢.٩٣ | ٢٢.٨٦ | ٢٢.٤٧ | ٢٢.٤٧ | ٢٢.٧٣ | ٢٢.٥٦ | ٢٢.٦٠ | ٢٢.٦٨ | ٢٢.٨٣ | ٢٢.٧١ |
| Mean | ٢١.٩٦ | ٢٢.١٨ | ٢٢.٤٠ | ٢٢.١٨ | ٢١.٦٣ | ٢١.٧٩ | ٢٢.٢١ | ٢١.٨٨ | ٢١.٧٩ | ٢١.٩٨ | ٢٢.٣١ | ٢٢.٠٣ |
| F value | ** | ** | Ns | | ** | ** | Ns | | ** | ** | * | |
| LSD ٠.٠٥ | A=٠.٤٧ | B=٠.١٨ | AB=-- | | A=٠.٦١ | B=٠.٣٠ | AB=-- | | A=٠.٣٢ | B=٠.١٧ | AB=٠.٢٩ | |

**Table ٥: Effect of different harvesting dates on sucrose%juice of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ١٦.٥٧ | ١٧.٤٣ | ١٧.١٧ | ١٧.٠٦ | ١٦.٣٧ | ١٧.٠٧ | ١٧.٠٣ | ١٦.٨٢ | ١٦.٤٧ | ١٧.٢٥ | ١٧.١٠ | ١٦.٩٤ |
| ١٢ months | ١٨.٥٣ | ١٨.٨٣ | ١٩.٣٣ | ١٨.٩٠ | ١٨.١٠ | ١٨.٥٠ | ١٨.٩٣ | ١٨.٥١ | ١٨.٣٢ | ١٨.٦٧ | ١٩.١٣ | ١٨.٧١ |
| ١٣ months | ١٩.٠٧ | ١٨.٧٠ | ١٩.٣٧ | ١٩.٠٤ | ١٨.٧٠ | ١٨.٣٧ | ١٩.١٣ | ١٨.٧٣ | ١٨.٨٨ | ١٨.٥٣ | ١٩.٢٥ | ١٨.٨٩ |
| Mean | ١٨.٠٦ | ١٨.٣٢ | ١٨.٦٢ | ١٨.٣٣ | ١٧.٧٢ | ١٧.٩٨ | ١٨.٣٧ | ١٨.٠٢ | ١٧.٨٩ | ١٨.١٥ | ١٨.٤٩ | ١٨.١٨ |
| F value | ** | * | Ns | | ** | ** | Ns | | ** | ** | ** | |
| LSD ٠.٠٥ | A=٠.٦٨ | B=٠.٤٤ | AB=-- | | A=٠.٥٣ | B=٠.٣٠ | AB=-- | | A=٠.٣٦ | B=٠.٢٥ | AB=٠.٤٤ | |

**Table ٦ :Effect of different harvesting dates on purity%juice of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٧٩.٥٤ | ٨٣.٠٢ | ٧٩.٦٠ | ٨٠.٧٢ | ٧٩.٤٧ | ٨٢.٣٣ | ٧٩.١١ | ٨٠.٣٠ | ٧٩.٥٠ | ٨٢.٦٧ | ٧٩.٣٥ | ٨٠.٥١ |
| ١٢ months | ٨٣.١٠ | ٨٣.٢٤ | ٨٥.١٧ | ٨٣.٨٤ | ٨٢.٩٠ | ٨٣.٤٨ | ٨٤.٦٦ | ٨٣.٦٨ | ٨٣.٠٠ | ٨٣.٣٦ | ٨٤.٩١ | ٨٣.٧٦ |
| ١٣ months | ٨٤.٨٨ | ٨١.٦٦ | ٨٤.٤٥ | ٨٣.٦٦ | ٨٣.٢٥ | ٨١.٧٦ | ٨٤.١٦ | ٨٣.٠٦ | ٨٤.٠٧ | ٨١.٧١ | ٨٤.٣١ | ٨٣.٣٦ |
| Mean | ٨٢.٥١ | ٨٢.٦٤ | ٨٣.٠٧ | ٨٢.٧٤ | ٨١.٨٧ | ٨٢.٥٢ | ٨٢.٦٤ | ٨٢.٣٥ | ٨٢.١٩ | ٨٢.٥٨ | ٨٢.٨٦ | ٨٢.٥٤ |
| F value | Ns | Ns | Ns | | * | Ns | Ns | | ** | Ns | ** | |
| LSD ٠.٠٥ | A٢.٧٧ | B=٢.٤٣ | AB=-- | | A=٢.٦٠ | B=-- | AB=-- | | A=١.٦١ | B=-- | AB=٢.٢٥ | |

## The effect of cultivar and harvest time on yield

**Table ٧ :Effect of different harvesting dates on pol% of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ١٣.٩٣ | ١٤.٢٩ | ١٤.٤٦ | ١٤.٢٤ | ١٣.٨٠ | ١٤.٠٦ | ١٤.٤٠ | ١٤.٠٩ | ١٣.٨٨ | ١٤.١٨ | ١٤.٤٣ | ١٤.١٦ |
| ١٢ months | ١٥.١٨ | ١٥.٤١ | ١٥.٥٩ | ١٥.٣٩ | ١٤.٨٥ | ١٥.١١ | ١٥.٣٢ | ١٥.٠٩ | ١٥.٠٢ | ١٥.٢٧ | ١٥.٤٦ | ١٥.٢٤ |
| ١٣ months | ١٥.٥٢ | ١٥.٤٩ | ١٥.٧٠ | ١٥.٥٧ | ١٥.٣٠ | ١٥.٢٠ | ١٥.٥٤ | ١٥.٣٥ | ١٥.٤١ | ١٥.٣٥ | ١٥.٦٢ | ١٥.٤٦ |
| Mean | ١٤.٨٩ | ١٥.٠٦ | ١٥.٢٥ | ١٥.٠٧ | ١٤.٦٥ | ١٤.٧٩ | ١٥.٠٩ | ١٤.٨٤ | ١٤.٧٧ | ١٤.٩٣ | ١٥.١٧ | ١٤.٩٦ |
| F value | ** | ** | Ns | | ** | ** | Ns | | ** | ** | | |
| LSD ٠.٠٥ | A=٠.٣١ | B=٠.١٣ | AB=-- | | A=٠.٣٥ | B=٠.١٦ | AB=-- | | A=٠.٢٠ | B=٠.١٠ | AB=٠.١٧ | |

**Table ٨ :Effect of different harvesting dates on sugar recovery % of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ١٠.٩٠ | ١١.٦٥ | ١١.٣٢ | ١١.٢٩ | ١٠.٧٥ | ١١.٣٦ | ١١.٢١ | ١١.١١ | ١٠.٨٣ | ١١.٥١ | ١١.٢٧ | ١١.٢٠ |
| ١٢ months | ١٢.٤٣ | ١٢.٦٣ | ١٣.٠٧ | ١٢.٧١ | ١٢.١١ | ١٢.٤١ | ١٢.٧٧ | ١٢.٤٣ | ١٢.٢٧ | ١٢.٥٢ | ١٢.٩٢ | ١٢.٥٧ |
| ١٣ months | ١٢.٨٤ | ١٢.٤٩ | ١٣.٠٧ | ١٢.٨٠ | ١٢.٥٥ | ١٢.٢٦ | ١٢.٨٩ | ١٢.٥٧ | ١٢.٧٠ | ١٢.٣٧ | ١٢.٩٨ | ١٢.٦٨ |
| Mean | ١٢.٠٥ | ١٢.٢٥ | ١٢.٤٩ | ١٢.٢٧ | ١١.٨١ | ١٢.٠١ | ١٢.٢٩ | ١٢.٠٤ | ١١.٩٣ | ١٢.١٣ | ١٢.٣٩ | ١٢.١٥ |
| F value | ** | ** | Ns | | ** | ** | Ns | | ** | ** | ** | |
| LSD ٠.٠٥ | A=٠,٥٨ | B= Ns | AB=-- | | A=٠.٤٣ | B=٠.٢٧ | AB=-- | | A=٠.٣١ | B=٠.٢٣ | AB=٠.٣٩ | |

**Table ٩ :Effect of different harvesting dates on reducing sugars%juice of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٠.٦٣ | ٠.٥٣ | ٠.٤٧ | ٠.٥٤ | ٠.٧٠ | ٠.٦٠ | ٠.٥٣ | ٠.٦١ | ٠.٦٧ | ٠.٥٧ | ٠.٥٠ | ٠.٥٨ |
| ١٢ months | ٠.٢٧ | ٠.٢٣ | ٠.٢٠ | ٠.٢٣ | ٠.٤٠ | ٠.٣٠ | ٠.٢٧ | ٠.٣٢ | ٠.٣٣ | ٠.٢٧ | ٠.٢٣ | ٠.٢٨ |
| ١٣ months | ٠.٥٣ | ٠.٤٧ | ٠.٤٠ | ٠.٤٧ | ٠.٥٠ | ٠.٧٣ | ٠.٤٧ | ٠.٥٧ | ٠.٥٢ | ٠.٦٠ | ٠.٤٣ | ٠.٥٢ |
| Mean | ٠.٤٨ | ٠.٤١ | ٠.٣٦ | ٠.٤٢ | ٠.٥٣ | ٠.٥٤ | ٠.٤٢ | ٠.٥٠ | ٠.٥١ | ٠.٤٨ | ٠.٣٩ | ٠.٤٦ |
| F value | * | * | Ns | | * | * | Ns | | ** | ** | Ns | |
| LSD ٠.٠٥ | A=٠.١٥ | B=٠.٠٩ | AB=-- | | A=٠.٢٠ | B=٠.١٠ | AB=-- | | A=٠.١٠ | B=٠.٠٦ | AB=-- | |

Concerning the evaluated sugar cane varieties ,data in Tables ٤ and ٥ indicated that the studied varieties of sugar cane differed significantly in total soluble solids% (TSS%) , sucrose%, pol%, sugar

recovery%, and reducing sugars % of sugar cane in the two growing seasons. It could be noticed from combined analysis that G.٨٤-٤٧ variety scored the highest values (٢٢.٣١٪, ١٨.٤٩٪, ١٥.١٧٪ and ١٢.٣٩٪) of total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery%, respectively as well as the lowest value (٠.٣٩٪) of reducing sugars %. The lowest values (٢١.٧٩٪, ١٧.٨٩٪, ١٤.٧٧٪ and ١١.٩٣٪) were recorded for total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery%, respectively. The highest value (٠.٥١٪) of reducing sugars %was recorded for G.T.٥٤-٩ variety. This result might be due to the action of gene make-up , which plays an important role in plant structure and morphology . These findings are in the same line with that observed by Nasser *et al.* (٢٠٠٦) and Ferweez *et al. (٢٠١١).*

A significant interaction was found between harvesting date and sugar cane varieties (AB) with regard to total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery% in the combined as shown in Tables (٤ till ٨). The highest values(٢٢.٨٣٪, ١٩.٢٥٪, ١٥.٦٢٪ and ١٢.٩٨٪) of total soluble solids% (TSS%) , sucrose%, pol% and sugar recovery%, respectively were obtained by the interaction between harvesting date at ١٣ months and G.٨٤-٤٧ variety. While the highest value (٨٤.٩١٪)of purity% was scorded by the interaction between harvesting date at ١٢ months and G.٨٤-٤٧ variety .

**C – Productivity traits :**

Data in Tables ٢ & ٣ clarified that harvesting date of sugar cane had a significant effect on millable cane and recoverable sugar yields of sugar cane in the two growing seasons. It could be noticed from the combined analysis that harvesting date of sugar cane at ١٢ months recorded the highest values (٤٨.٦٦ and ٦.١١ tons/fed.)of millable cane and recoverable sugar yields of sugar cane, while the lowest values (٤٢.٧٣ and ٤.٧٨ tons/fed.) were found with harvesting date of sugar cane at ١١ months , respectively. This results might be due to the increase in stalks height and diameter as well as quality parameters of sugar cane with the increase in crop age from ١١ to ١٢ months but decrease at ١٣ months age as a result of decrease the purity%.Similar results were obtained by El.Sogheir &Besheit,(٢٠٠٣)and Abd El-

## The effect of cultivar and harvest time on yield

Azez(٢٠٠٨)who stated that the highest values of millable cane and recoverable sugar yields of sugar cane were recorded at ١٢ months age .

**Table ١٠ :Effect of different harvesting dates on millable cane yield(ton/fed) of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٤١.٩٠ | ٣٨.٦٧ | ٣٩.٦٧ | ٤٠.٠٨ | ٤٥.٧٠ | ٤٣.٠٠ | ٤٧.٤٣ | ٤٥.٣٨ | ٤٣.٨٠ | ٤٠.٨٣ | ٤٣.٥٥ | ٤٢.٧٣ |
| ١٢ months | ٤٨.١٠ | ٤٥.٣٣ | ٤٣.٨٠ | ٤٥.٧٤ | ٥١.٣٧ | ٤٩.٥٧ | ٥٣.٨٠ | ٥١.٥٨ | ٤٩.٧٣ | ٤٧.٤٥ | ٤٨.٨٠ | ٤٨.٦٦ |
| ١٣ months | ٤٧.٠٧ | ٤٤.١٣ | ٤٢.١٣ | ٤٤.٤٤ | ٤٨.٩٣ | ٤٨.٤٣ | ٥٠.٣٧ | ٤٩.٢٤ | ٤٨.٠٠ | ٤٦.٢٨ | ٤٦.٢٥ | ٤٦.٨٤ |
| Mean | ٤٥.٦٩ | ٤٢.٧١ | ٤١.٨٧ | ٤٣.٤٢ | ٤٨.٦٧ | ٤٧.٠٠ | ٥٠.٥٣ | ٤٨..٧٣ | ٤٧.١٨ | ٤٤.٨٦ | ٤٦.٢٠ | ٤٦.٠٨ |
| F value | ** | ** | | Ns | ** | ** | | Ns | ** | ** | | ** |
| LSD ٠.٠٥ | A=٠.٧٧ | B=٠.٤٩ | | AB=-- | A=٠.٨٦ | B=٠.٩٣ | | AB=-- | A=٠.٤٨ | B=٠.٥٠ | | AB=٠.٨٦ |

**Table ١١ :Effect of different harvesting dates on sugar yield(ton/fed) of some sugar cane varieties .**

| Harvesting date (A) | ٢٠٠٩/٢٠١٠ season | | | | ٢٠١٠/٢٠١١ season | | | | Combined | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sugar cane variety (B) | | | | | | | | | | | |
| | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean | G.T.٥٤-٩ | G.٢٠٠١-٧٩ | G.٨٤-٤٧ | Mean |
| ١١ months | ٤.٥٦ | ٤.٥٠ | ٤.٤٩ | ٤.٥٢ | ٤.٩٢ | ٤.٨٩ | ٥.٣٢ | ٥.٠٤ | ٤.٧٤ | ٤.٧٠ | ٤.٩١ | ٤.٧٨ |
| ١٢ months | ٥.٩٨ | ٥.٧٢ | ٥.٧٣ | ٥.٨١ | ٦.٢٣ | ٦.١٦ | ٦.٨٧ | ٦.٤٢ | ٦.١٠ | ٥.٩٤ | ٦.٣٠ | ٦.١١ |
| ١٣ months | ٦.٠٤ | ٥.٥١ | ٥.٥١ | ٥.٦٩ | ٦.١٤ | ٥.٩٤ | ٦.٤٩ | ٦.١٩ | ٦.٠٩ | ٥.٧٢ | ٦.٠٠ | ٥.٩٤ |
| Mean | ٥.٥٣ | ٥.٢٥ | ٥.٢٤ | ٥.٣٤ | ٥.٧٦ | ٥.٦٦ | ٦.٢٣ | ٥.٨٨ | ٥.٦٥ | ٥.٤٥ | ٥.٧٣ | ٥.٦١ |
| F value | ** | ** | | Ns | ** | ** | | Ns | ** | ** | | Ns |
| LSD ٠.٠٥ | A=٠.٣٢ | B=٠.١٩ | | AB=-- | A=٠.٣١ | B=٠.١٧ | | AB=-- | A=٠.١٩ | B=٠.١٢ | | AB=-- |

Concerning the evaluated sugar cane varieties , data in Tables ١٠ & ١١ indicated that the studied varieties of sugar cane differed significantly in millable cane and recoverable sugar yields of sugar cane in the two growing season. It could be noticed from the combined analysis that G.T.٥٤-٩ variety scored the highest value (٤٧.١٨ tons/fed ) of millable cane yield , while the lowest value (٤٤.٨٦ tons/fed ) found for G.٢٠٠١-٧٩. The G.٨٤-٤٧ variety scored the highest value (٥.٧٣ tons/fed ) of recoverable sugar yield, while the lowest value (٥.٤٥ tons/fed.) was found for G.٢٠٠١-٧٩. This result might be due to G.٨٤-٤٧ variety contained the the highest values of

sucrose% and sugar recovery%.These results are in harmony with those obtained by Nasser *et al.* (٢٠٠٦) and Ferweez *et al. (٢٠١١).*

A significant interaction was found between harvesting date and sugar cane varieties (AB) with regard to millable cane yield in the combined as shown in Tables (١٠). The highest value (٤٩.٧٣ tons/fed.) of millable cane yield were obtained by harvesting date at ١٢ months and G.T.٥٤-٩ variety, while the lowest value (٤٠.٨٣ tons/fed.) was scorded by harvesting date at ١١ months and G.٢٠٠١-٧٩ variety .

In general, it could be concluded from the results that harvesting date at ١٢ months age G.٨٤-٤٧ variety scored the highest value (٥.٧٣ tons/fed.) of recoverable sugar yield, and therefore, it could be recommended for maximizing sugar cane productivity under El-Minia governorate conditions.

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# تأثير الصنف وميعاد الحصاد على ناتج وجودة فصب السكر

**خليل الشناوي محمد ، على محمد علوان و سحر فايز توفيق**

جمهورية مصر العربية ،مركز البحوث الزراعية ،معهد بحوث المحاصيل السكرية

يمثل ميعاد الحصاد في محصول قصب السكر واحد من العوامل المهمة لعملية التصنيع، خاصة في الدول النامية . لذا أقيمت تجربتين حقليتين بمزرعة محطة البحوث الزراعية بملوي، محافظة المنيا، مصر خلال موسمي ٢٠٠٩/٢٠١٠، ٢٠١٠/٢٠١١ لدراسة تأثير ميعاد الحصاد عند ١١ ، ١٢ و ١٣ شهر على ناتج و جودة بعض أصناف قصب السكر تحت ظروف محافظة المنيا. وكان التصميم المستخدم هو القطع المنشقة مرة واحدة وباستخدام أربع مكررات حيث وضع ميعاد الحصاد ١٢.١١ و ١٣ شهراً في القطع الرئيسية بينما أصناف قصب السكر (جيزة – تايوان ٥٤- ٩ ( الصنف التجاري) ، جيزة ٢٠٠١-٧٩ و جيزة ٨٤- ٤٧ في القطع المنشقة.

أوضحت النتائج المتحصل عليها ما يلي :-

١- ظهر تأثير معنوي لميعاد حصاد القصب على مقاييس جودة العصير (نسبة المواد الصلبة الذائبة الكلية، نسبة السكروز ، نسبة النقاوة ، نسبة الحلاوة ، نسبة استخلاص السكروز، نسبة السكريات المختزلة) ، وكذلك الصفات الإنتاجية (نواتج العيدان القابلة للعصر و السكر القابل للاستخراج ) فى موسمى التجربه .

٢- اختلفت الأصناف المختبرة (جيزة- تايوان٥٤- ٩ ، جيزة ٢٠٠١-٧٩ و جيزة٨٤ – ٤٧) معنويا فى ارتفاع العود ، صفات جودة العصير (نسبة المواد الصلبة الذائبة الكلية، نسبة السكروز، نسبة الحلاوة ، نسبة استخلاص السكروز، نسبة السكريات المختزلة) ، وكذلك الصفات الإنتاجية ( نواتج العيدان القابلة للعصر و السكر القابل للاستخراج) فى موسمى التجربه .

٣- لوحظ تفاعل معنوى بين ميعاد الحصاد واصناف محصول قصب السكرالمختبرة بشان نسبة المواد الصلبة الذائبة الكلية، نسبة السكروز ، نسبة الحلاوة ، نسبة استخلاص السكرو ناتج العيدان القابلة للعصر وسجل صنف جيزة٨٤ – ٤٧ عند الحصاد على عمر ١٢ شهر القيمة الاعلى لناتج السكر (٥.٧٣ طن/فدان) القابل للاستخراج ولذلك يمكن التوصية بهما لتعظيم الإنتاجية لقصب السكر تحت ظروف محافظة المنيا.