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Title of thesis: Breeding for Yield and Quality Traits in Sugarcane

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ABSTRACT

Thirty sugarcane clones (*Saccharum spp.*) that selected from six bi-parental crosses (families) along with two check cultivars (GT54-9 and Ph8013) were laid out in a randomized complete block design with three replications. The aims were to evaluate the performance of yield and quality traits in plant cane (PC) and first ratoon crops (FR) at the first clonal selection stage, estimate broad-sense heritability and genetic variance components and to determine phenotypic and genotypic correlation coefficients among ten agronomic characters and to analyze their interrelationships through path coefficient analysis under Upper Egypt conditions at Shandweel Agricultural Research Station, Sohag Governorate, Egypt during 2013 and 2014 harvesting seasons. Results indicated significant differences among evaluated clones for stalk length, stalk diameter, stalk weight, number of stalks /fed, cane yield, Brix%, sucrose %, purity%, sugar recovery% and sugar yield in plant cane, first ratoon and across crops. Across plant cane and first ratoon the clones, G2009 - 30 (67.17 ton/fed), G2009-7(64.41 ton/fed), G2009-10 (63.49 ton/fed) and G2009-18 (62.72 ton/fed) surpassed the two check cultivars for cane yield, while, the highest sugar yield was recorded with clones, G2009-10 (9.02 ton/fed), G2009-27 (8.25 ton/fed), G2009- 2 (8.25 ton/fed), and G2009-21 (8.17 ton/fed). Genotypic variance, heritability, phenotypic and genotypic coefficient of variation decreased from plant cane to first ratoon for the traits of stalk diameter , cane yield and Brix%, while, they increased slightly for number of stalks /fed and purity%. Results showed that phenotypic and genotypic correlation between cane yield and its components, viz. stalk diameter, stalk weight and number stalks/fed were highly significant in the positive direction in plant cane, first ratoon and across crops. There was also a positive and significant correlation of cane yield with Brix% and sugar yield, however, insignificant correlation was observed with stalk height at phenotypic and genotypic level in both plant cane and first ratoon crops. On the other hand, sugar yield recorded a positive and highly significant phenotypic and genotypic correlation with each of stalk diameter, stalk weight, number of stalks/fed, cane yield, Brix%, sucrose percentage and sugar recovery %, while this trait gave a negative and insignificant correlation with stalk height in both plant cane and across crops. Path coefficient analysis revealed that stalk weight surpassed stalk number in their phenotypic and genotypic direct effects on cane yield in plant cane, first ratoon and across crops. Stalk diameter had a large positive direct effect on stalk weight followed by stalk length at phenotypic and genotypic level in both crops. Brix had a negative phenotypic and genotypic direct effect on sugar recovery, while, sucrose had a large positive phenotypic and genotypic direct effect on sugar recovery in both plant cane and first ratoon. The path analyses further showed that cane yield and sugar recovery% were the most important components that had phenotypic and genotypic direct effects on sugar yield. Both correlation and path coefficient analyses can provide some guide to breeders for selecting best clones and predicating selection gain.

Key words: Sugar cane (*Saccharum spp.*), plant cane, ratoon crops, clones, genetic variance, heritability, correlation, path coefficient.

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المستخلص

تم اختيار ثلاثين تركيب وراثى من قصب السكر ناتجة من ستة تهجينات ثنائية الأباء (عائلات) بالإضافة لسنفى المقارنة وهم (GT54-9, Ph8013) و استخدم تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات وذلك بهدف تقييمهم للمحصول وصفات الجودة فى موسم الغرس والخلفة الاولى ، بالإضافة لتقدير كفاءة التوريث فى المعنى العام ومكونات التباين الوراثية ، ثم تقدير معاملات الارتباط المظهرية والوراثية بين عشرة صفات محصولية وتحليل العلاقات المتبادلة بين هذه الصفات على المستوى الظاهرى والوراثى ، من خلال استخدام تحليل معامال المرور تحت ظروف مصر العليا فى محطة البحوث الزراعية بشندويل بمحافظة سوهاج فى مواسم الحصاد 2013 و 2014. أشارت النتائج إلى وجود فروق معنوية بين السلالات الخضرية فى معظم الصفات مثل صفة طول الساق، قطر الساق، ووزن الساق ، وعدد السيقان للقدان، ومحصول العيدان للقدان و البركس %، والسكروز %، و نسبة النقاوه %، و ناتج السكر % و محصول السكر فى موسم الغرس والخلفة. وأظهرت النتائج أن التراكيب الوراثية الواعدة والتي تجاوزت سنفى المقارنة بالنسبة لمحصول العيدان للقدان كانت هي جيزة 2009-30(67.17 طن للقدان) ، جيزة 2009-7(64.41 طن للقدان) ، جيزة 2009-10(63.49 طن للقدان) ، و جيزة 2009-18(62.72 طن للقدان) . فى حين تم تسجيل أعلى محصول سكر مع التراكيب الوراثية جيزة 2009-10(9.02 طن / فدان)، جيزة 2009-27(8.25 طن / فدان) ، جيزة 2009-2(8.25 طن / فدان) و جيزة 2009-21(8.17 طن / فدان). أشارت النتائج إلى انخفاض قيم التباين الوراثى، كفاءة التوريث، معامال الاختلاف المظهري والوراثى من الغرس للخلفة الأولى لمعظم الصفات المهمة مثل قطر الساق، ومحصول العيدان والبركس %، فى حين ارتفع قليلا لعدد السيقان فى الفدان، و نسبة النقاوه % . أظهرت النتائج وجود ارتباط ظاهرى ووراثى موجب ومعنوى بين محصول العيدان ومكوناته، مثل قطر الساق و وزن الساق ، و عدد العيدان للقدان فى كل من موسمى الغرس والخلفة الاولى وكان هناك أيضا ارتباط ظاهرى ووراثى كبير و إيجابى بين محصول العيدان وكل من نسبة البركس ومحصول السكر. ومع ذلك، لوحظ وجود ارتباط ظاهرى ووراثى غير معنوى مع طول الساق فى كل من موسم الغرس والخلفة الأولى . ومن ناحية أخرى، وجد ارتباط ظاهرى و وراثى موجب وعالى المعنوية بين محصول السكر و كل من قطر الساق و وزن الساق و عدد العيدان / فدان و محصول العيدان و البركس % و نسبة السكروز وناتج السكر. فى حين أظهرت هذه الصفة ارتباط ظاهرى ووراثى سالب غير معنوى مع طول الساق فى كل من موسمى الغرس والخلفة. وأظهرت نتائج تحليل وجود تأثير مباشر سالب على المستوى الظاهرى والوراثى للبركس على ناتج السكر فى حين أظهر السكروز تأثير مباشر عالى و موجب على ناتج السكر على المستوى الظاهرى والوراثى فى كل من م وسمي الغرس والخلفة . أظهر تحليل معامال المرور أن محصول العيدان وناتج السكر من أهم مكونات المحصول التي تؤثر على المستويين المظهري والوراثى فى محصول السكر . يساعد كل من معامال الارتباط ومعامال المرور فى توفير بعض الأدلة لمربى قصب السكر لاختيار أفضل السلالات ويتنبأ بالتحسين الوراثى المتوقع من الانتخاب.

الكلمات الدالة : قصب السكر ، قصب الغرس، الخلفات ، سلالة خضرية ، التباين الوراثى، التوريث، الارتباط ، معامال المرور .

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