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PERFORMANCE AND GENETIC VARIABILITY AMONG TROPICAL SWEET CORN INBRED LINES DEVELOPED IN MALAYSIA

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PERFORMANCE AND GENETIC VARIABILITY AMONG TROPICAL SWEET CORN INBRED LINES DEVELOPED IN MALAYSIA

By

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CERTIFICATION

This study report entitled "Performance and Genetic Variability among Tropical Sweet Corn Inbred Lines Developed in Malaysia" is prepared by Nur Shila binti Rahim and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

A study was conducted to compare the performance of 27 tropical sweet corn (*Zea mays* L. *saccharata*) inbred lines, to estimates heritability of important traits measured, to determine correlations among the traits and to find out the genetic variability among the inbred lines evaluates based on their agronomic characteristics. The study was conducted in Randomized Complete Block Design (RCBD) with tree replications, at Field 16, Universiti Putra Malaysia (UPM). The inbred lines showed significant variation in agronomic performance. Among the inbred lines, FTT-1 was found to have the highest husked and dehusked ear yield (15,872 kg/ha), highest husked and dehusked ear weight (15,819 kg/ha), highest dehusked ear diameter (45.58 mm) and highest number kernel rows per ear (17.80). Inbred HSE-1 was the earliest in day of tasseling (44.33 days from planting) and days to silking (45.66 days from planting). NTS-2 was the highest in husked ear diameter (48.49 mm), while HAV-3 pocessed the highest Total Soluble Solids concentration (15.26%). Inbred TSST produced the tallest plants (230 cm) and had the highest ear placement (125.63 cm). All these inbred lines (FTT-1, HSE-1, HAV-3 and TSST) had superior characteristics making them potential for further development of hybrid varieties. High estimates of broad-sense heritability (h^2_B) was obtained on dehusked ear yield with heritability of 77.79%, followed by number of kernels per row (77.08%), dehusked ear weight (75.82%), number of kernel rows per ear (75.08%), husked ear yield (68.14%), dehusked ear length (67.81%), husked ear weight (67.47%), ear height (61.55%) and plant height (60.94%). Simple correlation coefficients based on agronomic characteristics show that husked ear yield was highly positively correlated with dehusked ear yield, husked and dehusked ear weight,

dehusked ear length, husked and dehusked ear diameter, number of kernels per row and plant height (r= 0.931, 0.996, 0.928, 0.688, 0.842, 0.790, 0.775 and 0.531, respectively), while positively correlated with husked ear length, total soluble solids concentration and ear height (r= 0.398, 0.449 and 0.428, respectively). The lowest genetic distances was between HAW-4 and NTS-2 (normalize average Euclidean= 0.336), while inbred TSST (1.926 dissimilarity coefficients) had high genetic differentiation. The outcome from this morphological evaluation can be further complete with molecular marker analysis to reveal the variation among the inbred lines at DNA level, so that the precise selection can be made for production of superior hybrid varieties in Malaysia.

ABSTRAK

Satu kajian telah dijalankan untuk membandingkan prestasi 27 jagung manis tropika (*Zea mays* L. *saccharata*) titisan inbred, anggaran keterwarisan ciri-ciri penting yang diukur untuk menentukan korelasi antara sifat-sifat dan untuk mengetahui kepelbagaian genetik di antara titisan inbred menilai berdasarkan ciri-ciri agronomi. Kajian ini dijalankan di Rekabentuk Blok Berawak Lengkap (RCBD) dengan 3 replikasi, di Ladang 16, Universiti Putra Malaysia (UPM). Titisan inbred menunjukkan perbezaan yang ketara dalam prestasi agronomi. Diantara semua titisan inbred dalam kajian, FTT-1 didapati mempunyai hasil tongkol dengan dan tanpa kulit tertinggi (15,872 kg/ha), berat tongkol dengan dan tanpa kulit tertinggi (15,819 kg/ha), diameter tongkol tanpa kulit tertinggi (45.58 mm) dan jumlah baris bijian pada setiap tongkol tertinggi (17.80). Inbred HSE-1 adalah yang paling awal pada hari pentaselan (44.33 hari dari hari menanam) dan hari perambutan (45.66 hari dari hari menanam). NTS-2 pula tertinggi dalam diameter tongkol dengan kulit (48.49 mm) manakala HAV-3 tertinggi dalam jumlah kepekatan pepejal terlarut (15.26%). Inbred TSST menghasilkan pokok yang paling tinggi (230 cm) dan mempunyai tempat tongkol tertinggi (125.63 cm). Semua titisan inbred (FTT-1, HSE-1, HAV-3 dan TSST) mempunyai ciri-ciri unggul yang menjadikan mereka berpotensi untuk memajukan varieti hibrid. Anggaran ketinggian keterwarisan (h^2_B) telah diperolehi pada hasil tongkol tanpa kulit dengan keterwarisan 77.79%, bilangan bijian setiap baris (77.08%), diikuti oleh berat tongkol tanpa kulit (75.82%), bilangan baris bijian setiap tongkol dengan kulit (68.14%) , panjang tongkol tanpa kulit (67.81%), berat tongkol dengan kulit (67.47%), ketinggian tempat tongkol (61.55%) dan ketinggian pokok (60.94%). Pekali korelasi mudah berdasarkan ciri-ciri

agronomi menunjukkan bahawa hasil tongkol dengan kulit adalah korelasi sangat positif dengan hasil tongkol tanpa kulit, berat tongkol dengan dan tanpa kulit, panjang tongkol tanpa kulit, diameter tongkol dengan dan tanpa kulit, bilangan bijian setiap baris dan tinggi pokok (r = 0.931, 0.996, 0.928, 0.688, 0.842, 0.790, 0.775 dan 0.531 masing-masing), manakala positif korelasi dengan panjang tongkol dengan kulit, jumlah kepekatan pepejal terlarut dan ketinggian tempat tongkol (r = 0.398, 0.449 dan 0.428 masing-masing). Jarak genetik yang terendah adalah antara HAW-4 dan NTS-2 (purata Euclidean yang dinormalkan= 0.336), manakala inbred TSST (1.926 pekali perbezaan Euclidean dengan individu) mempunyai perbezaan genetik yang tinggi. Hasil daripada penilaian morfologi ini boleh menjadi lagi lengkap dengan analisis penanda molekul untuk mendedahkan variasi dalam kalangan titisan inbred di peringkat DNA, supaya pilihan yang tepat boleh dibuat untuk pengeluaran varieti hibrid yang unggul di Malaysia.

CHAPTER 1

INTRODUCTION

Corn or maize (*Zea mays* L.) is an annual plant that belongs to the family of grasses (Poaceae). It is cultivated globally with total production estimates 989.19 million tons in year 2013/14 (USDA, 2013). Corn is the top three of the most important cereal crops worldwide, along with rice (*Oryza sativa*) and wheat (*Triticum* spp.) (FOASTAT, 2013).There are few types of corn that have been found in the world such as dent corn, flint corn, pop corn, waxy corn, pod corn, flour corn, and sweet corn. In developed and developing countries, the famous variety among the farmers as well as the consumers is sweet corn.

Sweet corn is a grain crop that grown in many climate zone. In Asia, sweet corn is grown in varied environmental condition, from tropical lowlands at sea level to high elevations in Himalaya region, from latitudes of 450N to 200S (De Leon and Paroda, 1993). USA is the biggest producer of sweet corn with total production approximately 4 million metric tons, followed by Nigeria with 750, 000 mt and Mexico with 700, 000 mt (USDA, 2013). However, the world's leading exporters of fresh and processed sweet corn include the United States, Hungary and Thailand.

Sweet corn (*Zea mays* L.*saccharata*) has great genetic variability and scope to improve its nutritive value. Moreover, sweet corn has a very big market potential not only in domestic market but also in the international market. In Malaysia, it has been favourable for most age groups. Each year, the corn productions have increase

because of the highly demanded in the country. To fulfil the supply, the farmers tend to choose hybrid corn seeds from Taiwan and Thailand rather than local open-pollinated composites seeds. This is because local open-pollinated seeds are late in maturity and less sweet. Hence, the quality of imported seeds are much better than the local seeds but the price of imported hybrid seeds are quite expensive and require high care costs for every season. Therefore, the development of local hybrid sweet corn seed is very necessary to reduce the burden of farmers on the high price of the imported hybrid seeds. Inbred line development is the main prerequisite for production of local F_1 hybrid varieties. This process is achieved through successive generations of inbreeding followed by repeated testing and selection. Since not all inbred lines are suitable for hybrid production, their performance should be evaluated before being selected to be parents for hybrids. This study was an advanced stage of a long-term tropical sweet corn inbred lines development program conducted at Universiti Putra Malaysia, where a series of near-homozygous inbred lines were formed from various tropical source populations.

The objectives of the study were:

1) To evaluate performance and genetic variability among the inbred lines based on their agronomic characteristics,
2) To estimates heritability of the traits measured on the inbred lines, and
3) To determine correlations among the traits measured on the inbred lines.

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