Comparative performance of two sweetcorn varieties – Mas Madu and Taiwan Supersweet
(Perbandingan prestasi dua varieti jagung manis – Mas Madu dan Taiwan Supersweet)

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Key words: sweetcorn varieties, Mas Madu, Taiwan Supersweet, cob characters, brix, yield

Abstract
A study was carried out to compare the performance of Mas Madu and Taiwan Supersweet; two popular sweetcorn varieties widely cultivated in this country. The effects of plant population, fertilizer level and organic manure on the production of the sweetcorn hybrid were determined. Mas Madu was superior to Taiwan Supersweet in cob production and cob length. There was no difference in the sweetness of the grains between the two varieties. Plant population and fertilizer level had no significant effect on yield and cob characters of Taiwan Supersweet. However, the use of organic manure in the form of chicken dung resulted in higher cob number and yield. Physical characters related to market demand between the two varieties were also discussed.

Introduction
Sweetcorn is a popular commodity that is widely cultivated in Malaysia. In 2000, the acreage of sweetcorn in Peninsular Malaysia was 4 795 ha with Johor, Kelantan and Pahang being the main producers at 1 123, 997 and 884 ha respectively (Anon. 2000a). It is estimated that the present acreage is insufficient to meet demand. Sweetcorn offers a stable market and MARDI has released some popular varieties like Manis Madu (Anon. 1987), Mas Madu (Wong 1990) and Improved Mas Madu (Anon. 1994).

Although these varieties are widely accepted by farmers, they have not been able to dominate the market where a significant share is taken up by imported sweetcorn hybrids, particularly Taiwan Supersweet. The latter’s popularity is mainly due to its attractive light yellow grain, uniform cob size and a perceived high level of sweetness. This study compared the performance of the imported Taiwan Supersweet with the local Mas Madu. The information obtained would also identify important agronomic characters for MARDI’s own sweetcorn hybrid development programme.

Materials and methods
The experiment was conducted at MARDI Seberang Perai. The soil was a moderately well-drained sandy clay loam and classified as an Oxic Dystropept (Anon. 1986). The rainfall was characterized by two wet seasons (monthly rainfall between 200–300 mm) from April to May and again from October to November. There was a distinct dry season (monthly rainfall below 150 mm) from December to March (Anon. 2000b). The sweetcorn hybrid tested was Taiwan
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Supersweet and the following agronomic parameters were evaluated:

- plant population per hectare
  53 333 (P1); (50 x 75 cm, 2 plants/point)
  38 095 (P2); (70 x 75 cm, 2 plants/point)
- fertilization rate per hectare
  460 kg NPK 13:10:21 + 2MgO + TE (F1)
  700 kg NPK 13:10:21 + 2MgO + TE (F2)
- organic manure per hectare
  0 t chicken dung (M1)
  20 t chicken dung (M2)

The check variety was the local composite Mas Madu which was planted at the standard density of 53 333 plants per ha, and the crop received 460 kg NPK as basal fertilizer. No chicken dung was applied to Mas Madu.

The NPK compound fertilizer (13:10:21 + 2MgO + TE) was banded along the rows at planting. Urea was used as a top dressing at four weeks after planting for all treatments at the rate of 133 kg/ha for F1 and 200 kg/ha for the F2 treatment plots. Chicken dung was incorporated into the soil during rotovation for treatment M2.

The experiment was irrigated using Sumisansui rain tapes placed along every alternate row. Weed control was carried out by a blanket spray of the pre-emergence atrazine at 3 litres/ha to all treatments immediately after planting.

The experimental design was a randomised complete block design with 4 replications. The number of treatment plots per replicate was 2 x 2 x 2 + 1 check, or a total of nine plots. Plot size was 4.5 m x 6.0 m. Harvesting was carried out at 65 days after planting.

Plant height was measured at 60 days after planting while the dry matter content was obtained from randomly selected five plant samples per treatment plot. The cob characters were cob length, cob girth and brix content, all taken at harvest. The cob length and girth gave an evaluation of the size of the cobs while the brix content is an indication of sweetness. Yield data included the number of harvested cobs per ha as well as their fresh weight (t/ha). Analyses of variance and Duncan Multiple Range Test were carried out on plot mean yields and other characters evaluated.

**Results and discussion**

Taiwan Supersweet had relatively uniform but shorter plants compared to Mas Madu, which was taller by about 40% (Table 1). This was reflected in the dry matter content where the weight differences were 50% in favour of Mas Madu. As far as crop characters were concerned, there were no differences in terms of cob girth and brix

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant ht. (cm)</th>
<th>Dry matter (g)</th>
<th>Cob no./ha (t/ha)</th>
<th>Cob yield (cm)</th>
<th>Cob girth (cm)</th>
<th>Brix content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1F1M1</td>
<td>128.0</td>
<td>329.6</td>
<td>26 110</td>
<td>6.6</td>
<td>18.1</td>
<td>4.3</td>
</tr>
<tr>
<td>P1F1M2</td>
<td>137.2</td>
<td>403.0</td>
<td>34 722</td>
<td>9.1</td>
<td>17.0</td>
<td>4.3</td>
</tr>
<tr>
<td>P1F2M1</td>
<td>128.2</td>
<td>293.1</td>
<td>26 250</td>
<td>6.9</td>
<td>17.2</td>
<td>4.3</td>
</tr>
<tr>
<td>P1F2M2</td>
<td>138.3</td>
<td>418.6</td>
<td>30 000</td>
<td>8.2</td>
<td>17.0</td>
<td>4.2</td>
</tr>
<tr>
<td>P2F1M1</td>
<td>131.5</td>
<td>370.5</td>
<td>21 944</td>
<td>6.2</td>
<td>18.1</td>
<td>4.3</td>
</tr>
<tr>
<td>P2F1M2</td>
<td>128.9</td>
<td>333.8</td>
<td>25 694</td>
<td>7.6</td>
<td>17.4</td>
<td>4.2</td>
</tr>
<tr>
<td>P2F2M1</td>
<td>125.9</td>
<td>389.5</td>
<td>23 472</td>
<td>6.6</td>
<td>17.2</td>
<td>4.1</td>
</tr>
<tr>
<td>P2F2M2</td>
<td>130.0</td>
<td>408.6</td>
<td>29 583</td>
<td>8.3</td>
<td>17.7</td>
<td>4.2</td>
</tr>
<tr>
<td>Check</td>
<td>214.6</td>
<td>745.6</td>
<td>39 305</td>
<td>10.3</td>
<td>19.4</td>
<td>4.4</td>
</tr>
<tr>
<td>P1 mean</td>
<td>132.9</td>
<td>361.1</td>
<td>29 270</td>
<td>7.7</td>
<td>17.3</td>
<td>4.3</td>
</tr>
<tr>
<td>P2 mean</td>
<td>129.1</td>
<td>375.6</td>
<td>25 173</td>
<td>7.1</td>
<td>17.6</td>
<td>4.2</td>
</tr>
<tr>
<td>F1 mean</td>
<td>131.4</td>
<td>359.2</td>
<td>27 117</td>
<td>7.4</td>
<td>17.6</td>
<td>4.3</td>
</tr>
<tr>
<td>F2 mean</td>
<td>130.6</td>
<td>377.5</td>
<td>27 326</td>
<td>7.5</td>
<td>17.3</td>
<td>4.2</td>
</tr>
<tr>
<td>M1 mean</td>
<td>128.4</td>
<td>345.7</td>
<td>24 444</td>
<td>6.5</td>
<td>17.6</td>
<td>4.2</td>
</tr>
<tr>
<td>M2 mean</td>
<td>133.6</td>
<td>391.0</td>
<td>30 000</td>
<td>8.3</td>
<td>17.3</td>
<td>4.2</td>
</tr>
</tbody>
</table>
content. Mas Madu also produced 10% longer cobs and 30% more cobs compared to Taiwan Supersweet.

The statistical analysis of the data is as shown in Table 2. This included a comparison between the performance of Mas Madu and Taiwan Supersweet, as well as the effects of different parameters like population, fertilizer levels and use of organic manure.

There were significant differences between Mas Madu and Taiwan Supersweet in plant height, dry matter, cob number, cob yield and cob length (Table 2). The presence of organic manure also significantly influenced the number of cobs produced and subsequently the yield. No significant interaction effects were detected.

**Plant height**
Mas Madu produced significantly taller plants (214.6 cm) as compared to Taiwan Supersweet (131.0 cm), which showed no significant difference in plant height due to the various planting distances, fertilizer levels or use of organic manure. Plant height was relatively uniform and this represents an attractive feature amenable to the mechanization of the crop.

**Dry matter**
Due primarily to differences in plant height, the dry matter content followed a similar pattern, with Mas Madu having significantly higher values (745.6 g) compared to Taiwan Supersweet (368.4 g) as shown in Table 3. The heavier production of foliage (Plate 1) would mean that Mas Madu is more suited for integrated farming, where the green foliage after harvest can still be used as fodder for animal feed.

**Number of cobs**
Mas Madu produced significantly more cobs (39 305 cobs/ha) than Taiwan Supersweet (27 222 cobs/ha). For the imported hybrid, the use of organic manure in the form of chicken dung affected cob production significantly (Table 1). This may mean a different production technique is required.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant ht.</th>
<th>Dry matter</th>
<th>Cob no.</th>
<th>Cob yield</th>
<th>Cob length</th>
<th>Cob girth</th>
<th>Brix content</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>352.96**</td>
<td>86.67**</td>
<td>9.66**</td>
<td>7.79**</td>
<td>10.25**</td>
<td>1.66 ns</td>
<td>3.93 ns</td>
</tr>
<tr>
<td>C2</td>
<td>1.67 ns</td>
<td>0.29 ns</td>
<td>2.50 ns</td>
<td>0.67 ns</td>
<td>0.68 ns</td>
<td>0.26 ns</td>
<td>0.45 ns</td>
</tr>
<tr>
<td>C3</td>
<td>0.07 ns</td>
<td>0.46 ns</td>
<td>0.01 ns</td>
<td>0.03 ns</td>
<td>0.77 ns</td>
<td>0.29 ns</td>
<td>1.70 ns</td>
</tr>
<tr>
<td>C4</td>
<td>3.03 ns</td>
<td>2.81 ns</td>
<td>4.59*</td>
<td>6.71*</td>
<td>0.77 ns</td>
<td>0.01 ns</td>
<td>0.97 ns</td>
</tr>
<tr>
<td>C5</td>
<td>0.23 ns</td>
<td>1.13 ns</td>
<td>0.93 ns</td>
<td>0.39 ns</td>
<td>0.06 ns</td>
<td>0.20 ns</td>
<td>0.16 ns</td>
</tr>
<tr>
<td>C6</td>
<td>2.24 ns</td>
<td>4.01 ns</td>
<td>0.06 ns</td>
<td>0.10 ns</td>
<td>0.52 ns</td>
<td>0.01 ns</td>
<td>1.29 ns</td>
</tr>
<tr>
<td>C7</td>
<td>0.40 ns</td>
<td>1.00 ns</td>
<td>0.06 ns</td>
<td>0.11 ns</td>
<td>1.59 ns</td>
<td>0.72 ns</td>
<td>1.80 ns</td>
</tr>
<tr>
<td>C8</td>
<td>0.23 ns</td>
<td>0.00 ns</td>
<td>0.49 ns</td>
<td>0.33 ns</td>
<td>0.03 ns</td>
<td>1.13 ns</td>
<td>2.70 ns</td>
</tr>
<tr>
<td>Mean</td>
<td>140.3</td>
<td>410.3</td>
<td>28 564</td>
<td>7.7</td>
<td>17.7</td>
<td>4.3</td>
<td>12.7</td>
</tr>
<tr>
<td>S.E.</td>
<td>8.39</td>
<td>76.42</td>
<td>7 331</td>
<td>1.92</td>
<td>1.14</td>
<td>0.23</td>
<td>0.73</td>
</tr>
<tr>
<td>CV (%)</td>
<td>6.0</td>
<td>18.6</td>
<td>25.7</td>
<td>24.9</td>
<td>6.5</td>
<td>5.4</td>
<td>5.7</td>
</tr>
</tbody>
</table>

C1 = Mas Madu vs Taiwan Supersweet
C2 = P1 vs P2
C3 = F1 vs F2
C4 = M1 vs M2
C5 = P x F interaction
C6 = P x M interaction
C7 = F x M interaction
C8 = P x F x M interaction
*Significant at 5% probability level
**Significant at 1% probability level
ns = Not significant
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Due to the greater number of cobs produced by Mas Madu, cob yield (10.3 t/ha) was significantly higher compared to Taiwan Supersweet (7.4 t/ha). For the hybrid, the use of organic manure resulted in significantly higher yields (8.3 t/ha as compared to 6.5 t/ha without organic manure). Plant population and fertilizer levels, on the other hand, did not influence yields significantly. Higher plant density (P1) resulted in a yield of 7.7 t/ha while the lower density (P2) had a 7.1 t/ha yield (Table 1).

Cob yield

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Cob length

Cob length is an important parameter as longer cobs generally fetch higher prices in the market. Mas Madu produced significantly longer cobs (19.4 cm) than Taiwan Supersweet (17.5 cm). However, none of the parameters of plant population, fertilizer level or use of organic manure had any significant effect on cob length for Taiwan Supersweet.

Cob girth

Cob girth refers to the diameter of the cob measured halfway along its length. Together with length, it gives an indication of the size of the cob. No significant difference in girth was detected either between Mas Madu (4.4 cm) and Taiwan Supersweet (4.2 cm), or among the parameters tested for the hybrid. This may indicate that cob size can be increased by manipulating factors that affect its length, rather than its girth.

Brix content

The brix content of the grain indicates the degree of sweetness of the cob. Sweeter grain showed higher brix readings. Mas Madu gave an average reading of 13.4 ºbrix while Taiwan Supersweet was 12.6 ºbrix. The difference was not statistically significant. The parameters tested for the hybrid also had no significant effect on the brix content of the grain.

Table 3. Mean values of Mas Madu and Taiwan Supersweet parameters

<table>
<thead>
<tr>
<th></th>
<th>Plant ht. (cm)</th>
<th>Dry matter (g)</th>
<th>Cob no.</th>
<th>Cob yield (t/ha)</th>
<th>Cob length (cm)</th>
<th>Cob girth (cm)</th>
<th>Brix content (º)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mas Madu</td>
<td>214.6a</td>
<td>745.6a</td>
<td>39 305a</td>
<td>10.3a</td>
<td>19.4a</td>
<td>4.4a</td>
<td>13.4a</td>
</tr>
<tr>
<td>Taiwan</td>
<td>131.0b</td>
<td>368.4b</td>
<td>27 222b</td>
<td>7.4b</td>
<td>17.5b</td>
<td>4.2a</td>
<td>12.6a</td>
</tr>
<tr>
<td>Supersweet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Means followed by a common letter are not significantly different at $p = 0.01$

Plate 1. Crop of Mas Madu with heavy foliage

for hybrids as most farmers do not use chicken dung for the cultivation of Mas Madu in mineral soils.
Mas Madu versus Taiwan Supersweet

In this evaluation, Mas Madu was superior to Taiwan Supersweet in some of the characters tested. None of the data showed that Taiwan Supersweet was superior to Mas Madu in any of the characters.

In terms of the number of cobs produced as well as the length of the cobs, Mas Madu was superior to Taiwan Supersweet. In the important criterion of sweetness, the brix content taken from the grain at harvest indicated no significant difference between the two sweetcorn varieties.

These findings showed that Mas Madu is in fact superior to Taiwan Supersweet. Not only did it produce more cobs, its production cost is lower. Based on current seed cost, Taiwan Supersweet seed is at least ten times more expensive than Mas Madu. Although the yield of the hybrid can be enhanced from 6.5 to 8.3 t/ha by the application of chicken dung, the increased yield was still lower than Mas Madu without manure application (10.3 t/ha). Moreover, the higher amounts of foliage produced by Mas Madu can be utilized for animal feed in an integrated farming system.

The continued demand for Taiwan Supersweet can be attributed to the public’s misconception that the ear-like wings at the tip of the Taiwan Supersweet cobs are an indication of superior quality and sweetness (Plate 2). The greener sheaths that wrap the cobs of the hybrid at harvest are also attractive aesthetically. The advantage of the hybrid lies in its uniform ripening facilitating a single harvesting operation. In Mas Madu, there is a tendency by farmers to wait a few days longer than necessary for more cobs to ripen, resulting in some overripe cobs. Time of harvesting and presentation of the harvested product are important criteria for market acceptability as far as sweetcorn is concerned.

Overall, what is most important in the marketing of Mas Madu is to ensure that all cobs are harvested at the optimum time to avoid overripe cobs. This will probably entail more than one harvesting operation. Farmers and entrepreneurs should also be aware that the sweetness of harvested cobs drops significantly after a few days when kept at room temperature. The marketing of the product should ideally be settled before harvesting begins. The other criterion is that, because Mas Madu is a composite, selection of pure seed is important and farmers should get fresh supply of certified seed from the Department of Agriculture or MARDI.

Conclusion

The sweetcorn variety Mas Madu is superior to Taiwan Supersweet in yield, with no significant difference in the sweetness of the grain. In the production of hybrid Taiwan Supersweet, only the use of organic manure increased yield, but not fertilizer rate or plant population.

Acknowledgement

The author would like to express his appreciation and thanks to Mr Yap Beng Ho for his help in the statistical analysis of the trial.

Plate 2. Ear-like wings at tip of cobs of Taiwan Supersweet
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References

Abstrak
Kajian telah dijalankan untuk membandingkan prestasi dua varieti jagung manis yang digemari, iaitu Mas Madu dan Taiwan Supersweet. Kesan kepadatan pokok, kadar pembajaan dan penggunaan baja organik terhadap pengeluaran jagung manis tersebut telah ditentukan. Varieti Mas Madu menunjukkan prestasi yang lebih baik bagi sifat pengeluaran tongkol dan tongkol yang lebih panjang. Walau bagaimanapun, tiada sebarang perbezaan dari segi kemanisan antara kedua-dua varieti ini. Kepadatan pokok dan kadar pembajaan tidak mempengaruhi hasil Taiwan Supersweet, tetapi penggunaan baja organik meningkatkan bilangan tongkol dan hasil tongkol. Ciri-ciri fizikal berkaitan dengan permintaan pasaran dibincangkan.