An experiment was conducted to know the intake and the milk yield of dual-purpose cows (American Brown Swiss and F1 Bo  
taurus x Bos indicus; n=28), with weight, age and lactation days of 430 ± 54 kg, 7 ± 2 years, and 122 ± 26 d, respectively. The animals were supplemented with Saccharina, elaborated with burnt and non-burnt sugarcane stalks, plus protein concentrate. The cows grazed on star grass. Later, according to the different treatments, complementary fodder was supplied individually: T1 = grazing + fresh integral sugarcane, with 1.5 % of urea + 2 kg in fresh basis of commercial concentrate; T2 = grazing + traditional Saccharina, mixed with 20 % of the commercial concentrate + 1 kg of commercial concentrate; T3 = grazing + Saccharina elaborated with burnt stalks, inoculated with 15 % of traditional Saccharina + 2 kg of commercial concentrate; T4 = grazing + traditional Saccharina + 2 kg of commercial concentrate. The study was performed according to a complete random design, and the initial milk production was used as covariable. The cows supplemented with fresh integral sugarcane and Saccharina with burnt stalks had higher intake (P < 0.05) than those supplemented with traditional Saccharina (5.24 and 4.52 vs 2.93 kg DM cow⁻¹ d⁻¹). However, the total intake (17.59, 14.94, 16.84 and 17.16 kg of DM cow⁻¹ d⁻¹) and the milk yield (8.47, 8.17, 7.72, and 8.04 kg cow⁻¹ d⁻¹) did not differ between themselves. The burnt sugarcane may be used as substrate to elaborate Saccharina for the intake of dual-purpose cows.

Key words: dual-purpose cows, Saccharina, supplements.

In the humid Mexican tropics, the cattle production is limited during the winter due to the low availability and poor quality of the pastures (Aranda 2000). Besides, in prairies, the rangelands are flooded, and thus, the lack of dry lands is also cause of stress for the animal (De Dios 2001). The sugarcane has been considered a fodder resource with potential due to its high biomass production (Aranda et al. 2003 and Martín 2004); however, it has nutritional deficiencies. The low content of nitrogen, the low fiber digestibility, and the reduced content of minerals make necessary the addition of a nitrogen source (Martín 1997 and Aranda 2000) or ferment it to improve its nutritive value (Elias et al. 1990 and Ramos 2005).

In Tabasco, sugarcane is burnt at the harvest time to be used in the sugarcane agribusiness; however, due to environmental effects and the accidental burn, it is largely left in the field. This represents around 20 % of the total sugarcane production sown (25 thousand ha⁻¹). The aim of this study was to evaluate the Saccharina elaborated with burnt sugarcane stalks and with clean crude stalks in the intake and milk yield of grazing dual-purpose cows.

Materials and Methods

The research was conducted on September and December (winter) in the lowlands of the ranch «El Marciob», in the Cardenas municipality, Tabasco, Mexico. Cardenas is located in northwestern part of the Tabasco State, between 18°05’ North latitude and 93°22’ West longitude, at 10 m a.s.l. The weather of this region is warm, humid, with abundant rainfall in summer (Am). The average temperature and rainfall are of 26.3°C and 2 240 mm, respectively (García 1988).

Twenty-eight crossbred dual-purpose cows (American brown Swiss and F1 Bo taurus x Bos indicus) were used with average liveweight, age, and lactation days of 430 ± 54 kg, 7 ± 2 years, and 122 ± 26d, respectively. They were distributed in four treatments, in a complete random design: T1 = grazing + fresh integral sugarcane, with 1.5 % of urea + 2 kg of commercial concentrate in fresh basis; T2 = grazing + traditional Saccharina, mixed with 20 % of the commercial concentrate + 1 kg of commercial concentrate; T3 = grazing + Saccharina elaborated with burnt stalks, inoculated with 15 % of traditional Saccharina + 2 kg of commercial concentrate; T4 = grazing + traditional Saccharina + 2 kg of commercial concentrate. The milk yield was adjusted by covariance. The initial milk yield was considered as covariable through the software GLM of SAS (2001). The mean comparison was performed according to LSMEANS (Steel and Torrie 1992).

The different types of Saccharina were fermented for 24 h. The methodology of Elias et al. (1990) was followed for the elaboration of the traditional Saccharina. The crude stalks, cleaned and between 19 and 20 ° Brix, were used. They were mixed with 1.5 % of urea and 0.5 % of mineral salts (P 12, Ca 13, Cl 15.6, Na 10.4, Mg 0.6, S 0.3, Zn 0.12, and Cu 0.01 in percentage respectively; Co 50.0, I 30.0, and Se3.0 ppm, respectively). The commercial concentrate was elaborated with 7 % of molasses, 2 % of meat meal, 55.1 % sorghum, 20.9 % of wheat bran, 0.6 % of lard in dust, 11.35 % of rice polishing, 1 % of calcium carbonate, 0.5 % of common salt, 0.7 % of urea, 0.15 % of mineral
premixture, 0.6 % of calcium orthophosphate, and
0.05 % of magnesium oxide. It contained 15.71, 28.08, and
4.36 % of crude protein (CP), neutral detergent fiber (NDF),
and acid detergent fiber (ADF), respectively.
The cows grazed from 7:00 to 11:30 h on 4.6 ha of African
star grass (Cynodon plectostachyus) in rotation (3 d of
occupation and 21 of resting), with a stocking rate of
6.0 LAU ha⁻¹. The next day, they were housed from 11:30 to
5:00 h. They were milked twice a day (5:00 and 15:30 h) for
90 d. In each milking, one kilogram of commercial concentrate
was supplied individually, except for T2. In this treatment,
0.5 kg was given because it was calculated that if consuming
5 kg of traditional Saccharina, mixed with 20 % of commercial
concentrate, they would be consuming 1 kg more of commercial
concentrate. The water was provided ad libitum.
The milk yield was measured individually at 16, 34, 55, 69,
and 86 d of the experimental period. Samples of the different
supplements and the pasture were collected and dried at
60 °C. The CP was determined according to AOAC (1980),
the true protein (TP), according to Jacobs (1965), and the NDF
and the ADF, according to van Soest et al. (1991). The intake
of the grass was estimated using the chromium oxide as
external marker and the ashes insoluble in acid, as internal
marker (Geerken et al. 1987). The chromium
concentration in the feces was determined
according to Williams et al. (1962), and the ashes
insoluble in acid in feces and feed, according
to Keulen and Young (1977). The in situ digestibility of the
different types of supplement was determined at 12, 24, 48, 72,
and 96 h of incubation, according to Mehrez et al. (1977).

Results and Discussion
The CP content of the sugarcane and of the different types
of Saccharina had significant (P < 0.05) differences. The content
of CP of the pasture ranged between 5 and 8 %. The
concentration of TP did not have differences in the different
types of Saccharina and reached values from 9.38 to 12.78 %,
due to the transformation of the energy of the sugars to microbial
protein (Elías et al. 1990). The values of protein were similar to
those of Monroy et al. (2006). The NDF and ADF in the sugarcane
did not have differences. The sugarcane used
for the elaboration of the Saccharina reached 20 ° Brix. That
used in the fresh form was younger and had 10.27 ° Brix (table
1). In general, the different types of Saccharina had higher
in situ digestibility (P < 0.01) since the 24 h up to the 96 h
of incubation. The Saccharina elaborated with commercial
protein concentrate had higher digestibility, compared with
the integral sugarcane, being followed by the traditional
Saccharina and the burnt Saccharina (P < 0.01). The intake
of the integral sugarcane and the burnt Saccharina was
higher than that of the traditional Saccharina (P < 0.01),
although there were nodifferences in the intake of pasture
and in the total (P < 0.05) (table 1), but in the index of
intake between the integral sugarcane, the burnt Saccharina

Table 1. Chemical composition, in situ digestibility, and intake of sugarcane, pasture, proteinic concentrate, and
total digestibility and intake index of the treatments

| Component | Integral sugarcane | Commercial proteinic concentrate | Burnt | Traditional | SE ±
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry matter</td>
<td>24.12 b</td>
<td>30.30 a</td>
<td>30.28 a</td>
<td>28.42 a</td>
<td>4.12</td>
</tr>
<tr>
<td>CP</td>
<td>3.49 b</td>
<td>16.38 a</td>
<td>12.34 a</td>
<td>16.50 a</td>
<td>5.21</td>
</tr>
<tr>
<td>TP</td>
<td>-</td>
<td>9.38 a</td>
<td>12.69 a</td>
<td>12.78 a</td>
<td>4.39</td>
</tr>
<tr>
<td>NDF</td>
<td>57.45</td>
<td>54.62 a</td>
<td>59.44</td>
<td>57.12</td>
<td>7.26</td>
</tr>
<tr>
<td>ADF</td>
<td>32.10</td>
<td>28.94 a</td>
<td>35.15</td>
<td>30.43</td>
<td>4.58</td>
</tr>
<tr>
<td>Sugars, °Brix</td>
<td>10.27</td>
<td>19.90</td>
<td>20.34</td>
<td>19.48</td>
<td>-</td>
</tr>
<tr>
<td>Digestibility, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>58.60</td>
<td>55.90</td>
<td>54.50</td>
<td>67.30</td>
<td>3.25</td>
</tr>
<tr>
<td>24</td>
<td>58.90 b</td>
<td>69.50 a</td>
<td>61.90 b</td>
<td>70.00 a</td>
<td>1.13</td>
</tr>
<tr>
<td>48</td>
<td>64.60 b</td>
<td>74.40 a</td>
<td>67.60 ab</td>
<td>75.10 a</td>
<td>1.39</td>
</tr>
<tr>
<td>72</td>
<td>66.90 d</td>
<td>79.30 a</td>
<td>71.60 a</td>
<td>75.50 b</td>
<td>0.48</td>
</tr>
<tr>
<td>96</td>
<td>68.40 d</td>
<td>80.00 a</td>
<td>71.80 b</td>
<td>75.80 b</td>
<td>0.14</td>
</tr>
<tr>
<td>Intake, kg cow⁻¹ d⁻¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>5.24 a</td>
<td>4.52 ab</td>
<td>4.67 a</td>
<td>2.93 b</td>
<td>0.78</td>
</tr>
<tr>
<td>Pasture</td>
<td>10.60</td>
<td>9.55 a</td>
<td>10.43</td>
<td>12.49</td>
<td>2.06</td>
</tr>
<tr>
<td>Proteinic concentrate</td>
<td>1.75</td>
<td>0.873</td>
<td>1.75</td>
<td>1.75</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>17.59</td>
<td>14.94 a</td>
<td>16.84</td>
<td>17.16</td>
<td>1.87</td>
</tr>
<tr>
<td>Total digestibility, %</td>
<td>66.26</td>
<td>58.96 a</td>
<td>64.17</td>
<td>62.61</td>
<td>1.84</td>
</tr>
<tr>
<td>Intake index</td>
<td>4.27 a</td>
<td>3.43 b</td>
<td>3.55 b</td>
<td>3.67 ab</td>
<td>0.31</td>
</tr>
</tbody>
</table>

a,b,c Means with different letters in the same row are different (P < 0.05);
1 Sugarcane or Saccharina according to treatment
The milk yield (table 2) did not show differences between the integral sugarcane and the various Saccharina feeds in the sampling times, despite the estimation of the intake of CP and ME was higher than the requirements. Maybe, there should have been influences of the environmental conditions because the study was developed during the most critical climatic circumstances, with higher rainfall and more mud. The body condition was favorable and was improved during the research, having from 3.0 to 3.69 at the end, in a scale of 5.0.

These results were slightly higher than those of Reyes et al. (1993), who worked with grazing Holstein grade cows, supplemented with 0.46 kg of feedstuff and 70% of Saccharina after the fifth liter of milk. These results were similar to those of García et al. (1994), but lower than those of Reyes et al. (1997) in Holstein cows, with 4000 L potential. They consumed Saccharina and a commercial feedstuff and fertilized pasture.

It is concluded that the burnt sugarcane, despite not showing differences in milk yield compared to the fresh integral sugarcane with urea and traditional Saccharina, may serve as substrate to elaborate Saccharina for dual-purpose cow feeding, because it does not change the chemical composition of this product, or the total intake of dry matter.

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Table 2. Milk yield of dual-purpose cows, fed sugarcane (kg cow⁻¹ d⁻¹)

<table>
<thead>
<tr>
<th>Experimental days</th>
<th>Integral sugarcane</th>
<th>Commercial proteinic concentrate</th>
<th>Burnt</th>
<th>Traditional</th>
<th>SE ±</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>9.35</td>
<td>8.97</td>
<td>8.71</td>
<td>9.47</td>
<td>1.37</td>
</tr>
<tr>
<td>34</td>
<td>9.54</td>
<td>8.48</td>
<td>7.86</td>
<td>8.10</td>
<td>1.05</td>
</tr>
<tr>
<td>55</td>
<td>8.07</td>
<td>7.70</td>
<td>6.87</td>
<td>7.02</td>
<td>1.18</td>
</tr>
<tr>
<td>69</td>
<td>6.86</td>
<td>7.53</td>
<td>8.14</td>
<td>7.88</td>
<td>1.26</td>
</tr>
<tr>
<td>87</td>
<td>7.14</td>
<td>7.13</td>
<td>6.60</td>
<td>7.40</td>
<td>1.03</td>
</tr>
<tr>
<td>Total daily milk yield, kg</td>
<td>8.47</td>
<td>8.17</td>
<td>7.72</td>
<td>8.04</td>
<td>0.93</td>
</tr>
</tbody>
</table>

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